NSW GOVERNMENT | Transport for NSW

Performance and Analytics

NSW Freight Commodity Demand Forecasts 2016-2056

FINAL REPORT

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1 Context, purpose and approach

1.1. Freight and Ports Plan and Future Transport

TPA has prepared NSW freight commodity demand volume forecasts for the 40 year period between 2016 to 2056 . These forecasts provided the underpinning evidence base for the recently completed NSW Freight and Port Plan 2018-2023 (FPP).

The FPP identifies actions needed to facilitate the movement of goods in an efficient, safe and environmentally sustainable manner that will result in successful outcomes for the community and the freight industry. The FPP has a 20 year horizon with a focus on practical actions that need to be delivered over the next 5 years. The forecasts in this report provide guidance on the likely growth, nature and underlying market drivers of freight commodity demand to identify where future freight network challenges may occur (i.e. strong forecast growth in commodity demand in particular regions could be an indicative signal of network capacity and/or reliability challenges arising in those particular regions at some point in the future). The forecasts act as a broad strategic signal of challenges that may need to be investigated and verified in greater detail to determine if and when appropriate investments or policies need to be implemented to increase efficiency, safety and environmental sustainability.

The forecasts will also support assessment of freight network investment or policy measures outlined in the FPP. Forty year demand forecasts have been prepared to support economic and financial evaluations of project proposals, which are typically done over a 30 year period as per NSW Government guidelines for project evaluation.

The FPP was prepared to align with the broader goals and objectives of Future Transport 2056 and State Infrastructure Strategy 2018 - 2038. While the FPP is a 20 year plan the forecasts here were prepared to be consistent with Future Transport 2056 and to support project and program appraisals and evaluation.

1.2. Stakeholder consultation

The development of the FPP was based on industry stakeholder consultation. TfNSW sought out industry's views on a range of freight strategy, operational and policy issues across all of NSW. The stakeholders included road and rail freight operators, freight forwarders, stevedores, port owners, freight associations, shippers (exporters, importers, companies selling into the domestic market), shipping lines, local councils and government departments.

As part of the stakeholder consultation process, feedback was sought from industry and other stakeholders on the commodity forecasts. Two participants provided feedback on the grain, aggregates and containerised freight forecasts. TPA subsequently revised its grain and container forecasts in response to the feedback.

1.3. Future updates

TPA aims to update the forecasts once in every two years. The scope of the update will mostly depend on the extent of changes to the key input forecasts used to produce the commodity demand forecasts. The key input forecasts are the travel zone projections (population, workforce and employment) from NSW Department of Planning and Environment and macroeconomic forecasts (covering industrial production, household income) prepared by Deloitte Access Economics (DAE).

1.4. Structure of this report

This report is structured as follows:

- Section 2 provides an overview of the key demand drivers of some major commodity forecasts. These are NSW population, employment, industrial production and household income;
- Section 3 provides a summary table of the commodity demand forecasts which underpin the NSW freight task for the 40 year period between 2016 and 2056. Forecasts are shown for specific commodities across three geographic origin destination markets: the Sydney Greater Metropolitan Area (GMA), NSW regional and NSW inter-capital[1]. In addition to the commodity demand forecasts themselves, charts are presented for selected commodities to convey a spatial sense of the forecast origins and destinations associated with the demand forecasts;
- Section 4 outlines the drivers and rationale used to produce demand forecasts for the key commodities moved in the Sydney greater metropolitan area (GMA). These are mainly manufactures and household commodities;
- Section 5 outlines the drivers and rationale used to produce demand forecasts for the key commodities moved in NSW regional areas. These are primarily agricultural and mining commodities;
- Section 6 outlines the drivers and rationale used to produce demand forecasts for the key commodities moved on inter-capital routes using the NSW road and rail network. These are primarily manufactures; and
- Section 7 provides a summary of the demand forecasts for Sydney GMA, regional NSW, NSW inter-capital and total NSW.

1.5. Overall forecasting approach

This report presents the base case, business as usual (BAU), projections of the future unconstrained freight tasks. It is important to recognise that the forecasts contained in this report reflect either end user demand or market supply for a commodity, therefore these forecasts generally do not reflect the total number of freight movements along a supply chain for a particular commodity. These forecasts are used to set the overall growth rates for each commodity which can then be applied to the respective supply chains for each commodity, this movement dataset is then used in network modelling and further assessment of the freight task.

The forecasts in this report are generated from base year estimates for commodity demand in 2016. All the 2016 numbers in this report are estimates of actual demand. The first forecast year is 2017 and the last forecast year is 2056. The preparation of the freight task forecasts in this report involved a mixture of methods including:

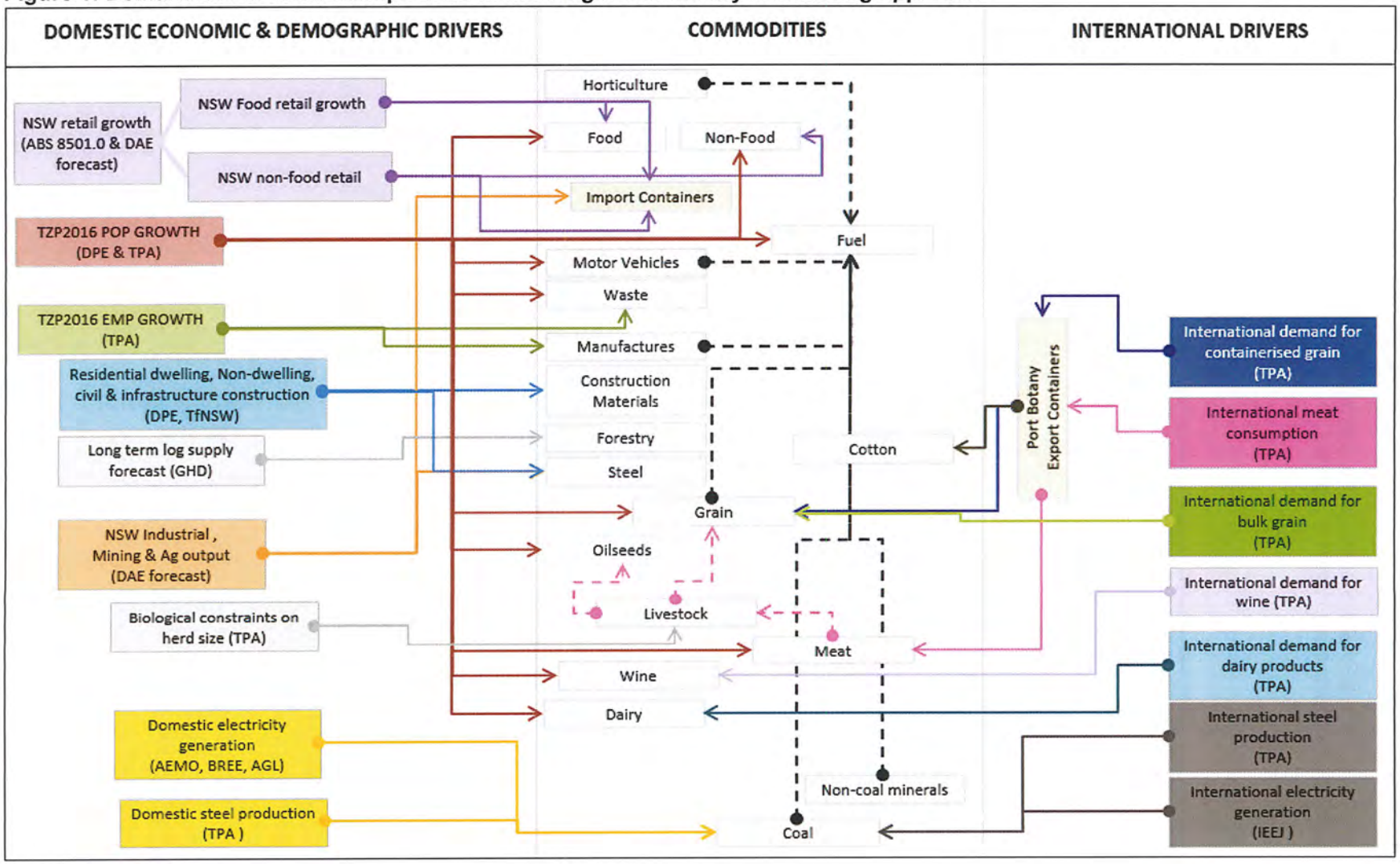
- General economic research and literature review as well as specific industry freight investigations (including those on construction materials, waste, forestry and electric vehicles);
- Data analysis and statistical modelling; and

[1]This geographical clustering based on Sydney GMA and Regional NSW, which is consistent with TPA's travel zone projections and other strategic modeling frameworks, is different to what is used in the FPP which reports on Greater Sydney and Regional NSW basis. The key distinction between the two is that in the former the Newcastle Statistical Subdivision and Illawarra Statistical Division are placed under the Sydney GMA whereas in the later they fall under Regional NSW. As a result of this clustering difference, the reported forecast figures in this report are different to those reported in the FPP.

- Application of TPA's transport models including the Strategic Freight Model (SFM), Sydney Freight Movement Model (FMM) and the Port Botany Sydney Airport Freight Movement Model (PB_SA_FMM).
- Consultation with other agencies including BITRE and NSW Department of Industry.

An overview of the relationships between the various domestic and international drivers to the commodity group forecasts is shown in Figure 1.

Figure 1: Demand driver relationships used in the freight commodity forecasting approach



Source: TPA analysis

2 Forecast demand drivers

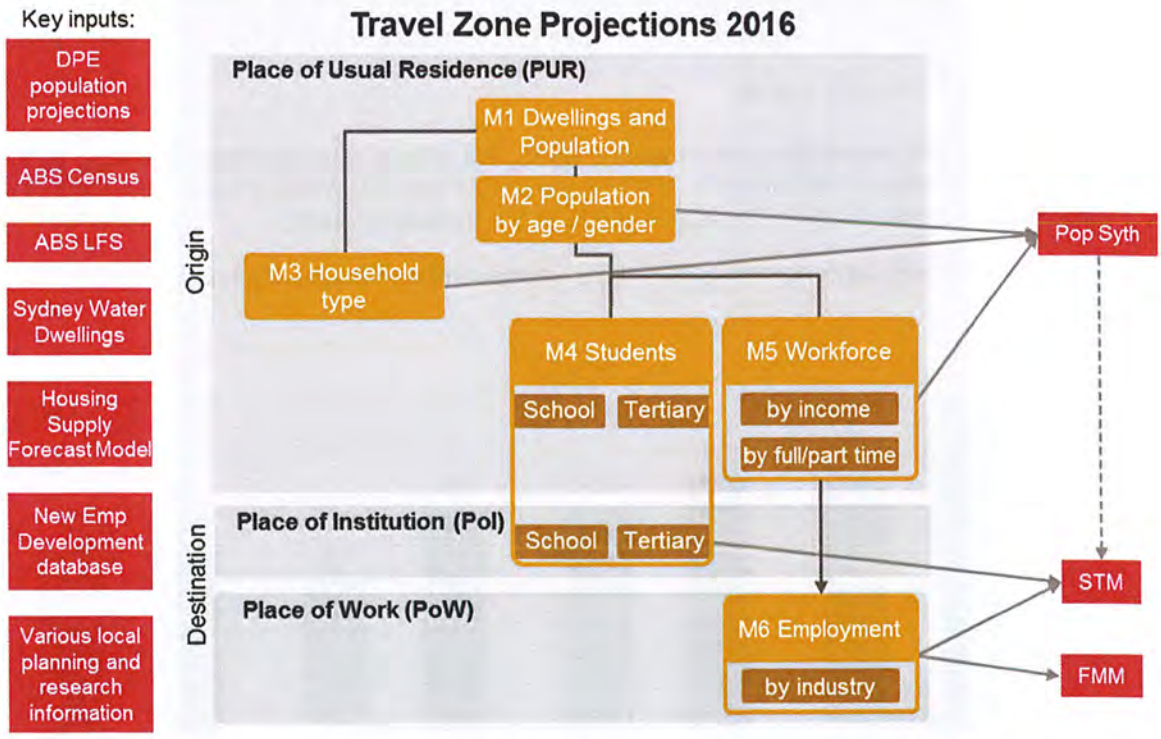
The key drivers behind some of the major commodity forecasts, shown in Figure 1 above, are detailed in this section.

2.1. NSW population and employment

The growth in NSW population and employment serves as a functional driver for growth in demand for many of the commodities. This includes commodities such as grain, retail goods, import containers, motor vehicles and waste. The distribution of population and employment helps to shape end user demand and travel patterns.

TPA has sourced the underlying population and employment data from the Travel Zone Projections 2016 dataset (TZP16), produced by TPA. This provides forecasts within the Common Planning Assumptions framework. An overview of this is presented in Figure 2.

Figure 2: Travel zone projections 2016 approach overview

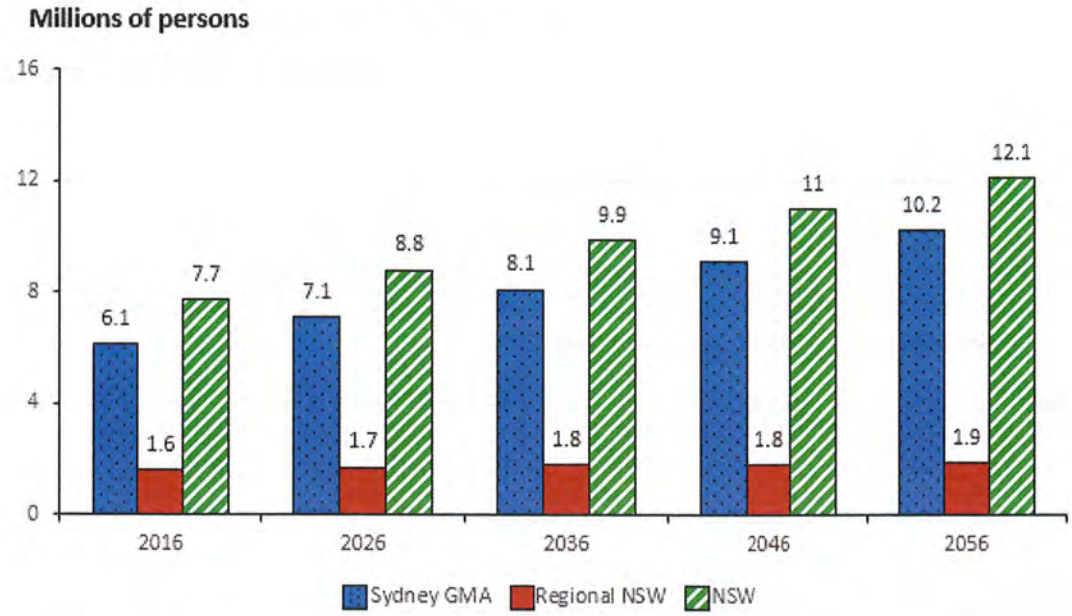


Source: 2016 Travel Zone Projections (TZP 2016) for Population, Workforce & Employment in the Sydney Greater Metropolitan Area.

This shows that local government population and household projections are segmented into travel zones. Population is then further disaggregated into age/gender, household type, education and work status. Whilst there are no official employment forecasts, workforce estimates are combined with an analysis of macroeconomic trends to project employment.

The overall growth in NSW population growth (made up of the Sydney GMA and Regional NSW), is forecast to reach over 12 million people by 2056. This is largely underpinned by growth in the Sydney GMA (depicted in Figure 3 below).

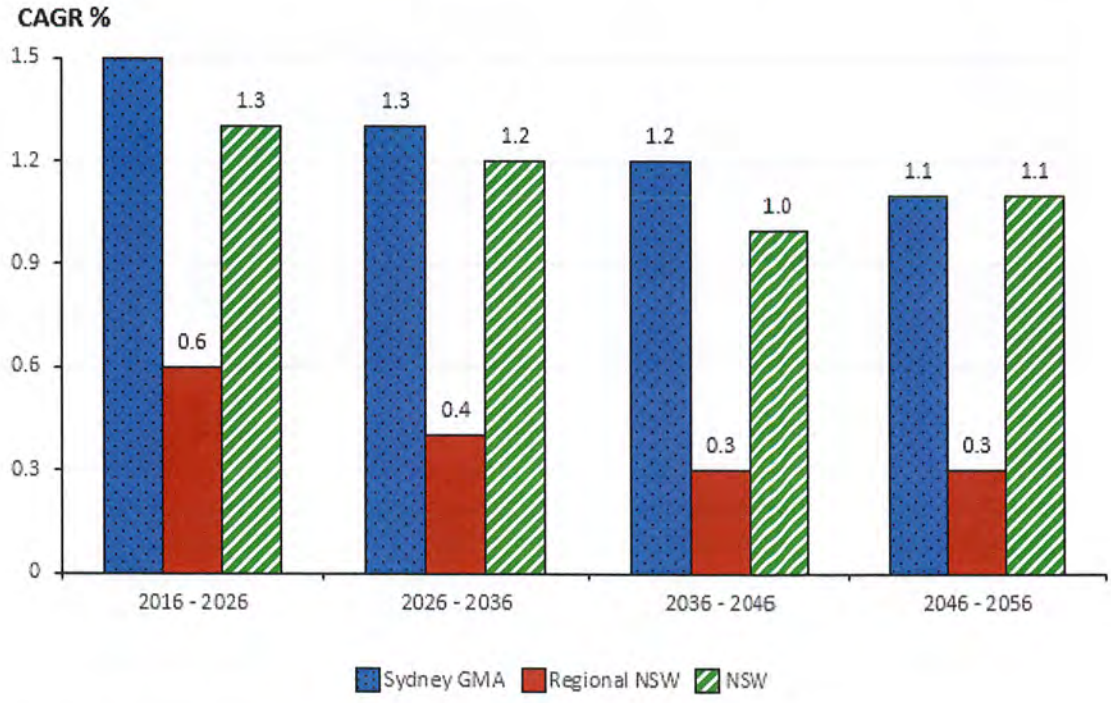
Figure 3: NSW population growth projections



Source: TZP 2016 population forecast

Whilst the overall population growth will increase, the annual rate of change in this growth is expected to decline in the long run. This is shown in Figure 4, which shows the compound annual growth rate (CAGR), for each decade in the forecast period.

Figure 4: NSW population growth projections, compound annual growth rate % (10 year intervals)



Source: TZP 2016 population forecast; TPA analysis

In terms of employment levels, TPA has sourced population forecasts for the Sydney GMA. At present, there is no agreed set of regional NSW employment projections. Regional

employment forecasts will be presented when an agreed upon modelling framework is developed. Employment levels are expected to grow at a rate that remains consistent with changes in population.

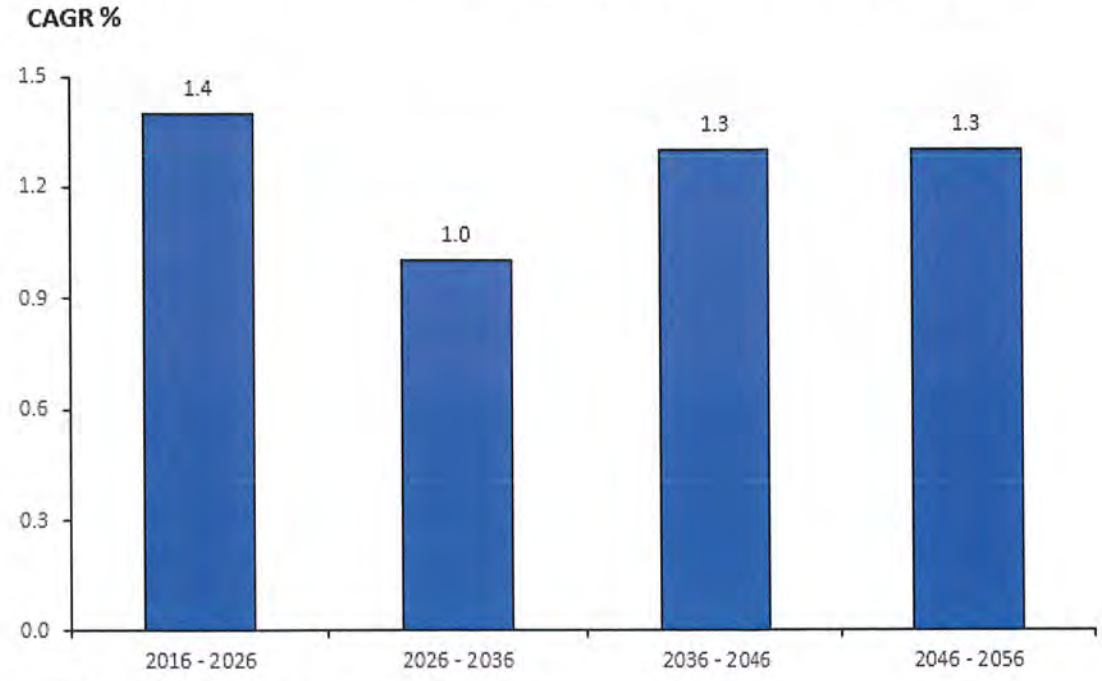
2.2. NSW industrial production

NSW industrial production (IP) underpins the forecasts of several key commodities. These include fuel demand from the manufacturing sectors, fuel being an input to production processes of manufacturers. Similarly, growth in IP has been used to forecast intermediate container imports, and steel production (indirectly, since steel production makes up a portion of total industrial production).

Forecasts for IP have been sourced from DAE, for the period 2017-2026. After this, IP is forecast to grow at the historical average of 1% p.a. from 2027-2036, and then 1.25% annually until 2056. This reflects an expected reversal in off shoring over the long run, with Asia (in particular China), likely to reach production capacity in this period (due to shortage of labour skills and environmental constraints).

These trends are displayed in Figure 5 below, showing the CAGR at 10 year intervals.

Figure 5: NSW industrial production – compound annual growth rate % (10 year intervals)



Source: TPA analysis, DAE Business Outlook

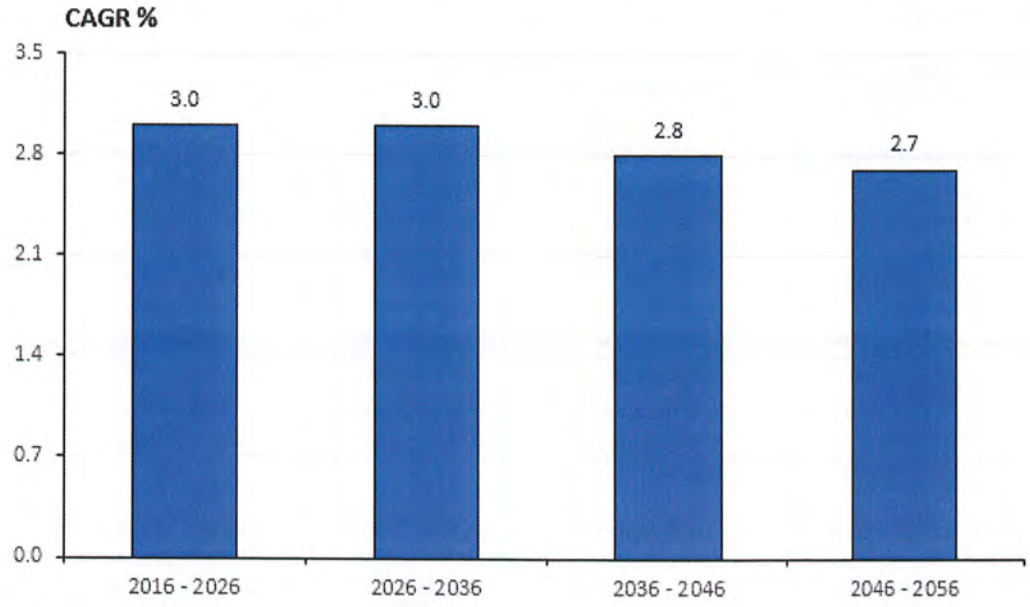
2.3. NSW household income

NSW household income, as represented by average weekly earnings (AWE), fundamentally underpins the end-user demand for several commodities. TPA has used AWE forecasts for the period 2017-2026 from DAE. For the remainder of the forecast period through to 2056, AWE has been estimated from forecast NSW population levels, and the historical average difference between population and AWE. This is because population growth coupled with income growth drives the demand for retail goods.

NSW AWE therefore underpins growth in NSW retail spending (food and non-food), and in turn, imports of food and non-food.

Forecast annual growth in NSW AWE is depicted in Figure 6 below.

Figure 6: NSW average weekly earnings – compound annual growth rate % (10 year intervals)



Source: TPA analysis, DAE Business Outlook

As demonstrated, NSW AWE is expected to grow in the period 2017-2026, before gradually declining in the long run. This gradual shift reflects the expected slowdown in annual NSW population growth.

3 Summary of forecast demand outputs

A summary of the NSW freight commodity demand forecasts for 2036 and 2056 are provided in Table 1 (Sydney GMA) and Table 2 (Regional NSW), respectively.

Table 1: Sydney GMA commodity demand forecasts, 2016-2056 (million tonnes per annum (mtpa)

Geographic market / commodity	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
General manufactures	133	188	261	1.7%	97%
Household consumables	21.7	36.0	56.6	2.4%	161%
Construction materials	40.1	48.3	61.3	1.1%	53%
Port Botany Full imports containers	9.2	17.2	27	2.7%	193%
Full exports containers	5.2	8.4	11.7	2.0%	125%
Total full containers	14.4	25.5	38.6	2.5%	168%
Fuel	11.2	14.4	17.2	1.1%	54%
Motor vehicles	0.7	0.9	1.1	1.1%	56%
Waste	12.6	18.0	22.4	1.4%	77%
Light commercial vehicles (million trip per annum)	421.0	553	692	1.2%	64%
Sydney GMA	**233**	**331**	**458**	**1.7%**	**96%**

Source: TPA analysis

Table 2: Regional NSW commodity demand forecasts, 2016-2056, mtpa

Geographic market / commodity	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Coal	189	210	230	0.5%	21%
Non coal minerals	2.4	2.4	2.4	0.0%	0%
Grains	8.4	10.6	12.9	1.10%	54%
Oilseeds	1.3	1.7	2.1	1.2%	62%
Edible oils	0.2	0.3	0.4	1.2%	100%
Livestock meals	0.5	0.7	0.9	1.4%	80%
Livestock	1.4	3.1	3.9	2.6%	179%
Red meat	0.6	1.3	1.6	2.6%	167%
Horticulture	1.5	1.8	2.2	1.0%	47%
Steel	3.8	4.4	5.0	0.7%	32%
Forestry	3.2	3.4	3.2	0.0%	0%
Cotton lint	0.4	0.5	0.7	1.4%	76%
Dairy	2.2	2.8	3.5	1.2%	60%
Grapes and wine	0.8	0.9	1.1	0.8%	38%
Regional NSW	216	244	270	0.6%	25%
Regional NSW (excluding coal)	27	34	40	1.0%	49%

Source: TPA analysis

Table 3 provides the inter-capital and total NSW freight commodity demand forecasts.

Table 3: NSW inter-capital and total NSW commodity demand forecasts, 2016-2056, mtpa

Geographic market / commodity	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
NSW inter-capital	**34**	**45**	**62**	**1.5%**	**83%**
Total NSW	**483**	**620**	**790**	**1.2%**	**64%**
Total NSW (excluding coal)	294	410	560	1.6%	90%

Source: TPA analysis

4 Sydney GMA

This section describes the current and forecast freight task to meet demand for commodities originating in and/or destined for the Sydney GMA. Forecasts and the rationale behind them are presented for the 40 years from 2016 to 2056. The commodities include:

- General manufactures
- Household consumables (food and non-food commodities)
- Construction materials
- Fuel
- Motor vehicles
- International export and import containers
- Waste

In addition to the commodity demand forecasts themselves, charts are presented for selected commodities to convey a spatial sense of the forecast origins and destinations associated with the demand forecasts.

The light commercial vehicle task that is commonly considered to be part of the GMA freight task is outlined in this section. This includes goods carried in small delivery vans plus construction materials and work equipment (tools) carried in utility vehicles. To this end, TPA has generated forecasts of light commercial vehicle (LCV) trips.

4.1. General manufactures

The current estimates and future forecasts of the production levels and freight requirements for the manufacturing sector are based on the methodology developed for the Sydney Freight Movement Model (FMM). In addition, the model results were validated and adjusted using data available from the ABS Road Survey 2014.

Statistical analysis of the ABS data supported the application of the following steps within FMM methodology:

- The total volumes of manufacturing tonnes can be calculated based on the number of employees and the estimated production rates obtained from previous surveys; and
- Additional production is determined for a number of areas identified as 'special generators locations' (ports and areas where major distribution centres are located).

When estimating total manufacturing freight being moved, consideration is given to transfers of goods produced between supply sources, special generators and regional and interstate producers. The nature of the supply chain makes it difficult to separate tonnages physically produced at each point as being distinct from the next step in the chain, however the current estimates reflect a high level assessment based on existing data sources.

The estimates of manufacturing production by SA3 areas for the base year (2016), 2036 and 2056 are presented in Table 4.

Table 4: General manufactures demand forecast by Sydney SA3 area, 2016 –2056, mtpa

Sydney SA3 area	2016	2036 (f)	2056 (f)	Total increase % (2016-2056)
Sydney-Inner	14.1	16.0	22.7	61%
Sydney – Blacktown	6.3	6.5	9.5	51%
Sydney - Baulkham Hills and Hawkesbury	2.3	3.5	5.8	152%
Southern Highlands and Shoalhaven	2.7	2.5	3.7	37%
Sydney - North Sydney and Hornsby	3.1	3.3	4.6	48%
Sydney - Northern Beaches	2.1	1.9	2.6	24%
Sydney - Outer South West	5.1	7.3	11.6	127%
Sydney - Outer West and Blue Mountains	4.6	6.1	9.0	96%
Sydney – Parramatta	11.9	16.7	23.5	97%
Sydney – Ryde	1.4	1.5	2.2	57%
Sydney - South West	9.3	11.4	18.6	100%
Sydney – Sutherland	2.0	1.7	2.3	15%
Central Coast	5.0	4.5	6.6	32%
Illawarra	2.5	2.3	3.4	36%
Newcastle and Lake Macquarie	5.6	4.9	6.9	23%
Hunter Valley exc Newcastle	11.8	15.7	22.1	87%
Eastern	3.5	5.3	6.6	89%
Northern	2.7	4.1	5.1	89%
Southern	3.4	5.2	6.5	91%
Other states	7.8	11.7	13.6	74%
Special other	3.5	12.3	16.8	380%
Port Botany	12.6	34.2	44.5	253%
Airport	0.2	0.2	0.4	100%
Newcastle Port	1.1	1.2	1.9	73%
Port Kembla	8.1	8.6	10.7	32%
Total	**133**	**188**	**261**	**96%**
Forecast growth from 2016	**-**	**42%**	**97%**	**NA**

Source: TPA analysis. Note: These estimates include freight sent from the regions into the Sydney GMA

4.2. Household consumables (food and non food)

TPA estimated overall freight demand for consumer commodities at the supply chain point between wholesale and retail distribution and distribution centre (DC) to retail store. The preceding parts of the supply chain (i.e. from production points to DCs) were estimated as individual commodity movements to the DC, which are covered in other sections of this report. These include:

- Import containers
- Dairy products
- Wine
- Vegetable and cooking oils
- Horticulture
- General manufactures

At the DC level, these individual commodities are mixed and generally palletised into loads of commodities required to replenish retail outlets. These movements have been classified as 'Food' and 'Non-Food' consumer commodities.

Food distribution dominates this sector (as opposed to other non-food merchandise goods like clothing, footwear, electronics and bulky commodities).

The estimation of wholesale to retail freight demand was on a 'top-down' approach using macro data based on population distribution and estimation of household consumption rates.

Consumption rates were estimated using the Retail Trade data from the ABS (8501.0) coupled with estimates of unit prices for food and non-food goods. Total consumption was validated against the relevant import categories.

These consumption rates per capita have been assumed to be constant across all NSW SA3s. Growth in retail consumption is based on the DAE forecast of growth of 2.8% p.a. over the next 10 years.

TPA converted the aggregated retail forecast from DAE to a chain volume measure of growth in food and non-food retail products, growing at 2.2% and 3.58% per annum respectively, until 2027.

Beyond 2027 to 2056 TPA forecasts that both NSW food and non-food consumption growth will converge towards an average of 2.3%. This is driven by population growth (TZP 2016) and AWE growth. The wholesale and retail freight demand for 2016, 2036 and 2056 is presented in Table 5 below.

Table 5: NSW household consumables demand forecast, 2016 – 2056, mtpa

Type of household consumable	End user market demand driver	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Food	Retail food consumption	15.5	24.5	38.5	2.3%	148%
Non-food	Retail non-food consumption	6.2	11.5	18.1	2.7%	192%
All	**All end user demands**	**21.7**	**36.0**	**56.6**	**2.4%**	**161%**

Source: TPA analysis

4.3. Construction materials

The construction material estimates are sourced from the Sydney Construction Materials Supply Chain Investigation report issued to TfNSW in August 2015. This sets out annual production capacity of the assets producing each material as well as demand for key materials, the location of demand and any changes in demand for construction materials in the Sydney GMA. The construction materials considered were:

- Cement and concrete: Cement is limestone that is combined with inputs like clay and heat treated. Concrete is a mixture of cement and broken stone or gravel;
- Quarry products (including sand): Aggregates (crushed rocks) and sand (including manufactured sand) are used in concrete production and also as a road base;
- Fly ash: This is a by-product of coal combustion and is used in concrete production as a supplement for cement to improve the strength of concrete;
- Slag: This is a by-product of steel production used in cement/concrete production. It can be used as a cement supplement or as an aggregate substitute. Slag is also an input into road stabilisation materials;
- Bitumen: Hydrocarbon product used for road surfacing and roofing;
- Timber: Includes hard and soft sawn wood used in construction;
- Bricks and masonry: Created from heat treated clay and commonly bound with mortar for use in construction;
- Steel: Alloy of iron and carbon commonly used in construction as structural beams, roofing, concrete reinforcement;
- Plasterboard: Solid sheets made from gypsum and paper;
- Glass: Heat treated silica, commonly combined with soda ash; and
- Spoil: Materials (dirt, rock) excavated from construction sites. Spoil is a by-product of production that typically has limited use in construction for filling land.

These construction activities are in turn driven by macroeconomic and demographic factors such as population growth and income growth. They are also heavily influenced by government policy, particularly land zoning policy. This investigation identified four key demand drivers that make up Sydney GMA's construction material demand, namely:

- Residential dwellings construction
- Non-residential construction
- Civil engineering works
- Major projects

With expected growth in population, residential dwellings construction is considered to be a key driver for construction materials demand. Residential dwellings construction includes redevelopment of established areas of Sydney and development of greenfields growth areas on Sydney's metropolitan fringes, with the construction of low, medium and high density dwellings for residential purposes.

Non-residential construction associated with expected population and employment growth is also identified as a key driver for construction materials demand. This includes construction of buildings and facilities for commercial use, including office, retail and industrial purposes.

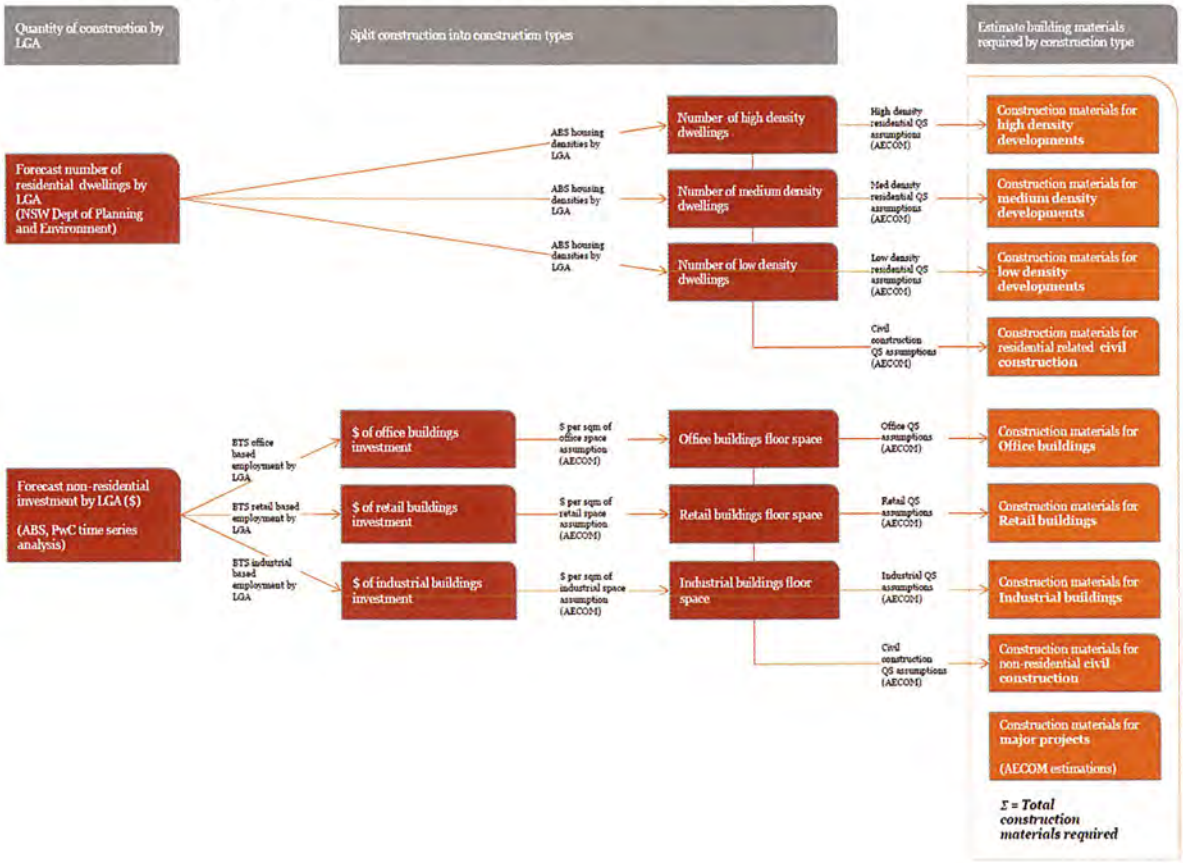
Another key driver for construction materials demand is civil engineering works including construction of roads, sewers, power stations and telephone infrastructure to service residential and non-residential developments.

Major infrastructure projects such as the construction of major highways, rail lines, new airports and sea ports are a key demand driver for construction materials.

The forecasting process involves estimating the volume of residential and non-residential buildings constructed by type of construction (m2 of office, retail and industrial floor space). The volume of residential building construction is estimated based on DPE's population forecasts. The forecast CAGR is 1.4% p.a. between 2016 and 2056. The volume of non-residential building construction is estimated based on DPE's employment forecasts as well as forecast business investment. The forecast CAGR is 1.7% p.a. between 2016 and 2056.

The volume of residential and non-residential building construction is then converted into the quantity of materials demanded by applying quantity surveyor (QS) assumptions. They take into account the type (residential and non-residential buildings and civil engineering) and form of development (green field or redevelopment). Construction materials demand arising from major infrastructure projects is estimated specifically for each project. This methodology is summarised in Figure 7.

Figure 7: Construction materials demand forecasting approach



Source: PwC Sydney Construction Materials Supply Chain Investigation, report for TfNSW Aug 2015

Forecast demand for each construction material type is shown in Table 6. The sum of these forecasts gives the Sydney GMA construction material demand forecasts contained in the forecast summary table at the front of this report.

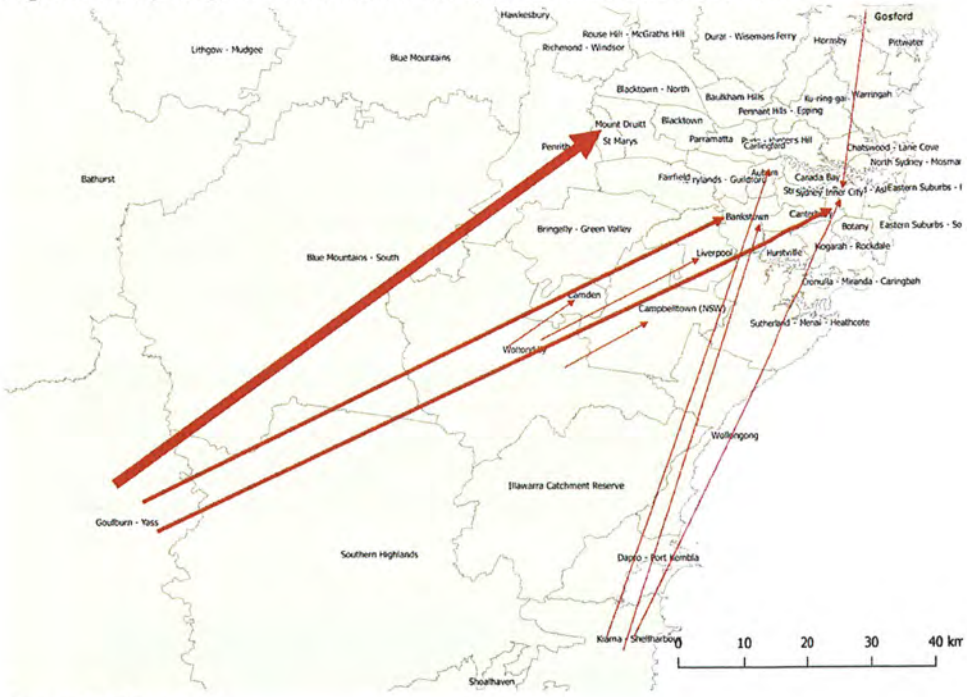
Table 6: NSW construction material demand forecasts, mtpa

Commodity type	End user market demand driver	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Bitumen	Residential, non-residential, civil, major infrastructure projects	0.6	0.5	0.6	0.1%	6%
Brick	Residential, non-residential, civil, major infrastructure projects	1.7	1.8	2.3	0.7%	34%
Concrete	Residential, non-residential, civil, major infrastructure projects	12.2	15.7	19.9	1.2%	63%
Fly ash	Residential, non-residential, civil, major infrastructure projects	1.1	1.5	1.9	1.4%	73%
Plasterboard	Residential, non-residential, civil, major infrastructure projects	0.7	0.9	1.1	1.2%	61%
Quarry and sand(1)	Residential, non-residential, civil, major infrastructure projects	19.5	24.7	31.4	1.2%	61%
Timber	Residential, non-residential, civil, major infrastructure projects	0.5	0.6	0.8	1.1%	52%
Glass	Residential, non-residential, civil, major infrastructure projects	0.1	0.1	0.1	0.6%	27%
Spoil	Residential, non-residential, civil, major infrastructure projects	3.7	2.5	3.2	-0.38%	-14%
All construction materials	**All end user demands**	**40.1**	**48.3**	**61.3**	**1.1%**	**53%**

Source: PwC Sydney Construction Materials Supply Chain Investigation, report for TfNSW Aug 2015, TPA analysis (1) Quarry and sand volumes replace GMA mining activities previously estimated by FMM

Figure 8 depicts the forecast origins-destinations for quarry material, the largest category of construction materials, sourced from non-Sydney regions to the Sydney region.

Figure 8: Key origins-destinations for quarry material demand, 2036 forecast



Source: TPA analysis

4.4. Containers

To produce forecasts of container volumes, all imports and exports were broken down into their constituent commodity groups. Baseline forecasts comprise container movements through Port Botany, which handles almost all of the containerised freight task for NSW.

By breaking down full container movements into key commodity groups the forecasts can be based on drivers relevant to each specific commodity. This also allows the conversion between tonnes and TEUs to be maintained for the respective commodity types which have different volume/mass profiles. The major commodity groups for full container imports and exports through Port Botany are shown in Table 7 and Table 8 respectively.

The 2016 estimates of full container movements are based on two primary sources: the MariTrade/ABS time series of freight tonnages (based on customs declarations) and TEU movements provided by NSW Ports. Both data sources comply with the Australian Harmonized Export Commodity Classification (AHECC) or an equivalent classification. This allows both TEU movements and tonnages to be aggregated into the broad commodity groups shown in Table 7 and Table 8.

Table 7: Port Botany full import container commodity composition, 2016

Commodity group	Million tonnes (MariTrade/ABS)	TEU (NSW Ports)	Tonnes / TEU
Intermediate goods	3.4	622,480	5.5
Non-food consumer goods	2.5	245,610	10.3
Food	1.9	151,140	12.2
Construction products (tiles and fixings)	1.1	51,260	21.1
Fertiliser	0.1	1,530	39.4
Other	0.2	43,790	5.5
Total	**9.2**	**1,115,810**	**8.3**

Source: TPA analysis, MariTrade/ABS, NSW Ports

Table 8: Port Botany full export container commodity composition, 2016

Commodity group	Million tonnes (MariTrade/ABS)	TEU (NSW Ports)	Tonnes / TEU
Intermediate goods	1.0	87,330	11.53
Grain, flour and starches	1.1	56,780	18.77
Paper and timber	0.9	60,490	15.48
Food other	0.7	39,980	17.95
Aluminium	0.5	25,530	19.78
Steel	0.2	22,070	10.83
Meat	0.2	14,080	14.88
Household goods	0.2	45,260	3.76
Cotton lint	0.2	13,980	11.11
Mineral ores and refined metals	0.1	2,490	26.21

Commodity group	Million tonnes (MariTrade/ABS)	TEU (NSW Ports)	Tonnes / TEU
Sugar	0.0	1,120	12.55
Other	0.1	44,660	2.84
Total	**5.2**	**413,770**	**12.6**

Source: TPA analysis, MariTrade/ABS, NSW Ports *Due to rounding at the one decimal place level, some values appear indeterminate at 0.0.

4.4.1. Full import containers

Growth forecasts for imports are shown in Table 9. Over the forecast period, the average growth rate for freight is expected to be 2.7%, while the growth in container volumes is expected to be more modest at 2.9%.

The difference in the growth rates for import tonnages and TEU reflects expected changes in tonnes per TEU over time. As the trend towards 40ft containers continues the average tonnes per TEU will decline. At present, 70% of import TEU's are 40ft containers. This is expected to rise to 77% by 2056.

Table 9: Port Botany full import container demand forecasts by commodity, 2016–2056[2], mtpa and '000 TEU

Commodity group	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)	2016 – '000 TEU	2036 (f) – '000 TEU	2056 (f) – '000 TEU	CAGR % (2016-2056)	Total increase % (2016-2056)
Fertiliser	0.1	0.1	0.1	1.1%	54%	2	2	2	1.2%	59%
Construction products	1.1	1.5	2.0	1. 6%	86%	51	74	102	1.7%	98%
Intermediate goods	3.4	4.2	5.6	1.2%	64%	622	1,002	1,381	2.0%	122%
Food	1.8	6.3	11.2	4.6%	508%	151	577	1,033	4.9%	583%
Non-food consumer goods	2.5	4.8	7.5	2.8%	197%	246	530	841	3.1%	243%
Other	0.2	0.4	0.6	1.6%	152%	45	89	137	2.9%	213%
Total	**9.2**	**17.3**	**27.1**	**2.7%**	**196%**	**1,116**	**2,274**	**3,496**	**2.9%**	**213%**

Source: TPA analysis

Intermediate goods, which are inputs to domestic production, are the largest category of container imports through Port Botany. Growth of the intermediate goods category is expected to be consistent with NSW industrial output as the proportion of the manufactured components that are imported is estimated to be large, 88% in 2016.

[2] Forecast includes Port Botany and future overflow to Port Kembla when the former's capacity is reached

DAE has forecast that NSW industrial production will grow at an average rate of 1.2% per annum from 2017 to 2027. TPA has projected the growth in NSW industrial output from 2027 to 2056 to remain at 1.2% per annum, with intermediate imports having a consistent growth rate.

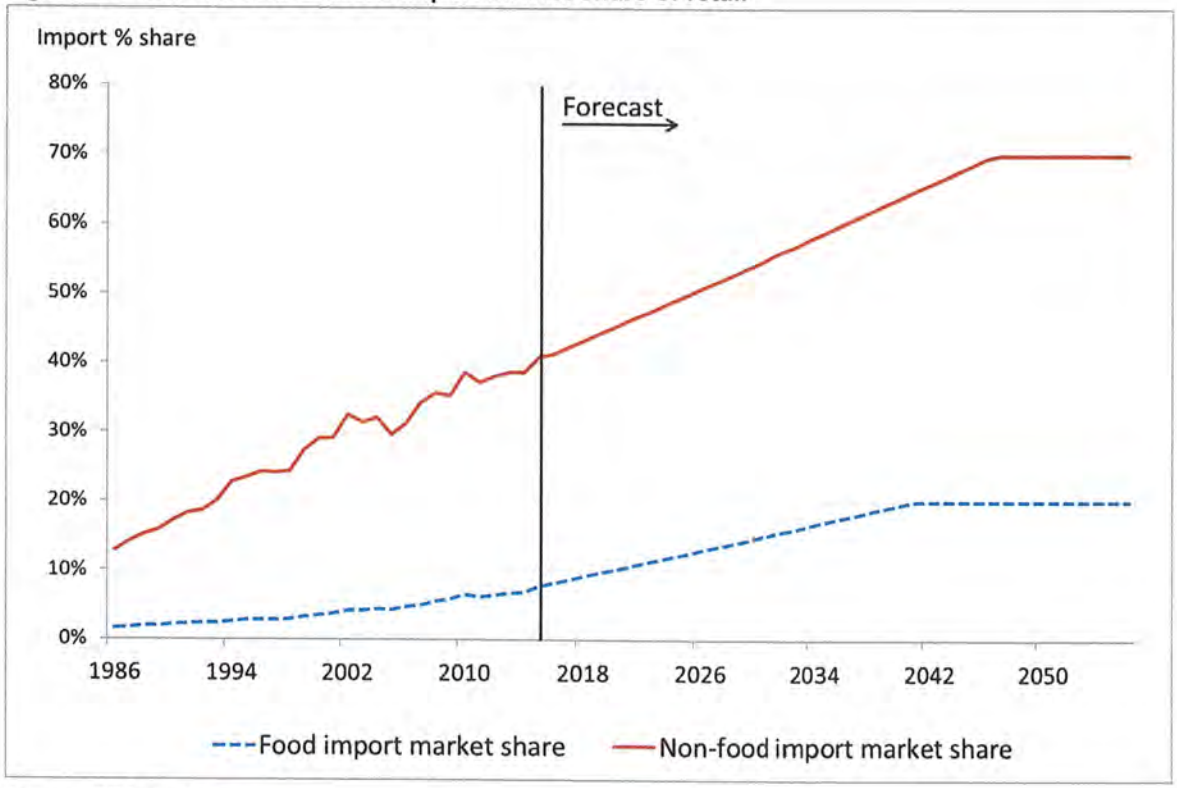
The largest areas of forecast containerised import growth are in food and non-food consumer goods, with 4.6% and 2.8% per annum growth rates over the forecast period. These growth rates are driven by growth in NSW household consumption of food and non-food products, with imports gaining greater market share in these areas.

DAE has forecast NSW household retail consumption (made up of food and non-food items) to grow at an average rate of 2.8% p.a. over the next 10 years.

TPA analysis estimates that within the 2.8% retail consumption growth forecast, NSW food consumption will grow at an average of 2.2% and NSW non-food consumption will grow at 3.9%. Beyond 2027 to 2056, the forecasts assume that both NSW food and non-food consumption growth will converge towards an average of 2.3%, driven by population growth plus average weekly earnings growth.

Containerised imports have a stronger growth rate compared to the forecast NSW consumption growth rates, as their market share is expected to increase. TPA has estimated the historical market shares for food and non-food retail goods, as shown in Figure 9.

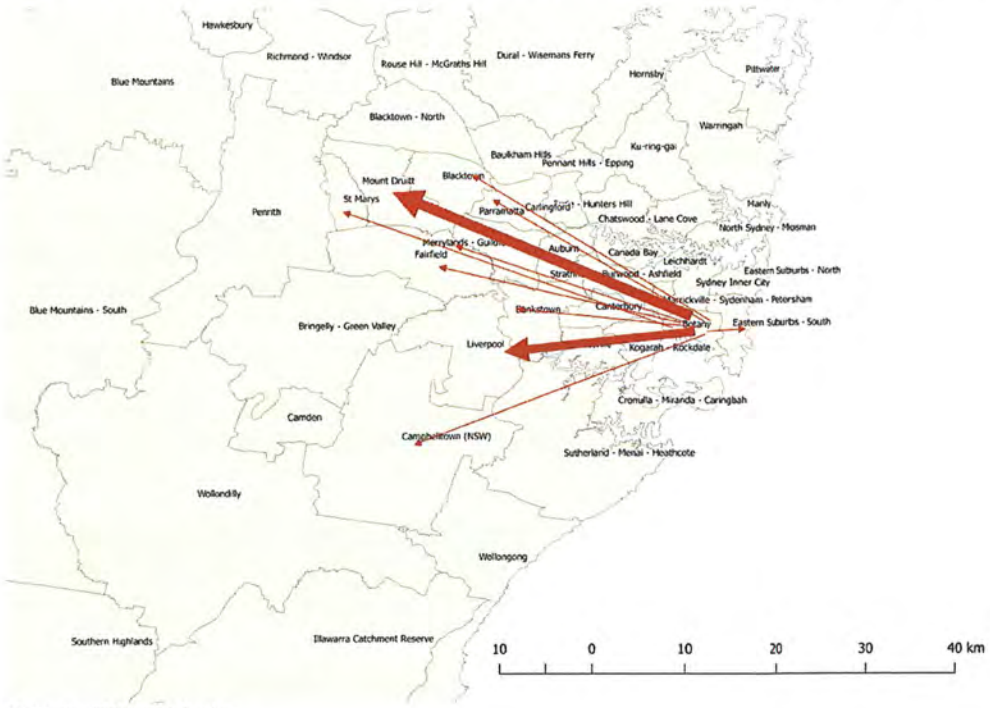
Figure 9: Historical and forecast import market share of retail



Source: TPA analysis

The major origins and destinations of import containers are displayed in Figure 10. These represent about 97% of total import containers moved.

Figure 10: Key origins and destinations of import container demand, 2036 forecast



Source: TPA analysis

4.4.2. Full export containers

As shown in Table 10, containerised exports are expected to grow at an average rate of 2.0% per year in terms of both tonnages and TEU, between 2017 and 2056.

Table 10: Port Botany full export container demand forecast, 2016 – 2056, mtpa and '0000 TEU

Commodity group	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)	2016 – '000 TEU	2036 (f) – '000 TEU	2056 (f) – '000 TEU	CAGR % (2016-2056)	Total increase % (2016-2056)
Intermediate goods	1.0	1.7	2.7	2.5%	165%	87	151	231	2.5%	165%
Grain, flour and starches	1.1	1.6	2.0	1.6%	91%	57	84	108	1.6%	91%
Paper and timber	0.9	1.7	2.6	2.6%	177%	60	106	162	2.5%	168%
Food other	0.7	1.1	1.4	1.6%	91%	40	59	76	1.6%	91%
Aluminium	0.5	0.5	0.5	0.0%	0%	26	26	26	0.0%	0%
Steel scrap	0.2	0.4	0.6	2.5%	165%	22	38	58	2.5%	164%
Meat	0.2	0.6	0.7	3.2%	250%	14	38	49	3.2%	250%
Household goods	0.2	0.3	0.5	2.5%	165%	45	78	120	2.5%	167%
Cotton lint	0.2	0.3	0.3	1.3%	68%	14	18	23	1.3%	65%
Other	0.1	0.1	0.1	0	0%	45	45	45	0%	0%

Mineral ores and metals	0.1	0.1	0.1	0%	0%	2	2	2	0%	0%
Sugar	0.0	0.0	0.0	1.6%	91%	1	2	2	1.7%	100%
Total	**5.2**	**8.3**	**11.5**	**2.0%**	**120%**	**414**	**648**	**903**	**2.0%**	**118%**

Source: TPA analysis. Due to rounding at the one decimal place level, some values appear indeterminate at 0.0.

By tonnage, the largest category of containerised exports are intermediate goods, which are partially transformed manufactures and components. The growth rate for intermediate goods has been assumed to be consistent with expected global economic growth rates. DAE has forecast global economic growth between 2017 and 2027 to average 2.5% per annum. These forecasts assume this growth rate will remain consistent until 2056.

Similarly, the other export categories which feed into international industrial production; paper & timber, steel scrap and household goods are forecast to grow consistently with expected global economic growth.

These forecasts should be viewed as being unconstrained from a production perspective and are primarily driven by demand for these products in the world market, i.e. constraints on domestic manufacturing, such as the availability of labour and electricity costs, have not been taken into account.

The commodity with the strongest growth rate during the forecast period is meat. It is expected to enter a strong growth phase. In the longer term, the growth rate for meat will be driven by strong global demand. Possible constraints on livestock numbers, which would impact on expected growth, have not been taken into account.

4.4.3. Total containers

Total container movement forecasts have been forecast as shown in Table 11.

Empty container exports have been calculated as 97% (rather than 100%) of the difference between full imports and full exports. This is due to the fact that traditionally a small share of empty containers (3%) leak out of the Port Botany container trade system for domestic freight uses. This is assumed to continue being the case over the forecast period. The reason for the leakage is as follows. After the contents of a full import container is unpacked the importer does not return the empty container to Port Botany (for loading onto ship) or to an empty container park near Port Botany (from where it is despatched to an exporter). Instead, the empty container is transferred to a domestic shipper who might use it to move goods to intercapital destinations (i.e. Brisbane or Melbourne). After the container is unpacked in Brisbane or Melbourne it is moved to Port of Brisbane or Melbourne.

Empty container exports are assumed to grow by 3.3% per annum over the forecast period. This is higher than the combined full imports and exports growth rate of 2.7% per annum. This is due to the difference between full imports and exports growing over time.

The volume of empty container imports has been assumed to grow at the same forecast rate as combined full imports and exports.

Trans-shipments make up the remainder of observed container movements, of approximately 2.36 million TEU in 2016. Like empty container imports, these have been assumed to grow at the same forecast rate as combined full imports and exports.

The forecast average growth rate of all containers is 2.9% per annum from 2016 to 2056.

Overall, TEU movements are expected to reach 7.34 million by 2056, an increase of 211% compared to 2016. Consistent with forecasts for other commodities presented in this report, container freight forecasts reflect expected overall changes in market demand and supply and

are independent of infrastructure use and capacity. As previously noted, the forecast demand for container movements, particularly exports, is assumed to be unconstrained.

Table 11: Total Port Botany TEU demand forecast, 2016 – 2056 ('000 TEU)

Commodity group	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Imports (full + empty)	1,125	2,290	3,520	2.9%	213%
Exports (full + empty)	1,096	2,226	3,419	2.9%	212%
Trans-shipments	140	268	403	2.7%	188%
Total	**2,360**	**4,783**	**7,341**	**2.9%**	**211%**

Source: TPA analysis

4.4.3.1. NSW Ports forecasts

The container forecasts in this report have been compared with the forecasts of NSW Ports, which holds the long term lease for Port Botany and Port Kembla. In late 2015, NSW Ports produced its 30-year master plan for Port Botany and Port Kembla, which includes container forecasts from 2015 to 2045.

Table 12 displays the TPA and NSW Ports forecasts for total containers through Port Botany. As shown in the table, NSW Ports' low range forecast (CAGR of 4.0% p.a.) is higher than the TPA forecast (CAGR of 3.2% p.a.) over the respective 30 year forecast period. The key reason for this is differences in forecast approaches. TPA is of the understanding that NSW Ports has used a top down macroeconomic approach (based on forecast NSW Gross State Product) to produce its forecasts whereas TPA has used a bottom up, commodity by commodity approach.

Table 12: Total Port Botany TEU demand forecast, TPA and NSW Ports comparison '000 TEU

	2016 (2015)	2046 (2045)	CAGR %
TPA forecast	2,360	6,070	3.2%
NSW Ports lower case forecast	2,300	7,500	4.0%

Source: TPA analysis, NSW Ports 30-Year Masterplan Nov 2015

TPA breaks export and import container volumes into commodities which in turn allows for forecasts to be based on the specific demand drivers and market dynamics relevant to each traded commodity. TPA considers this approach to be more robust than a top down approach where GSP reflects economic activity from all sectors of the NSW economy. This is because at particular times different sectors become the main driver for growth in GSP and they might be more or less reliant on containerised trade. TPA has observed that as the NSW coal mining boom slowed and construction became the main driver of NSW GSP growth, the relationship between GSP growth and container movements no longer provided a good fit to observed data.

TPA recommends that the 'bottom up' forecasts derived with respect to growth of key commodity groups be used in any further analysis or project assessment, with the NSW Ports' projections potentially being used as a high range forecast for the purpose of scenario analysis.

4.5. Fuel

The fuel demand forecasts reported here are unconstrained demand forecasts, that is forecasts reflecting end user demand independent of supply side constraints. Constraints include capacity limits at fuel import terminals, storage depots and on the landside freight network. The presence of such constraints would reduce the forecast tonnage demand reported here.

The fuel forecasts cover petrol, diesel and jet fuel.

TPA identified nine end user demand drivers that make up NSW fuel demand. The relatively high number of end users reflects the fact that fuel is demanded directly or indirectly by households, heavy industry and the services sector. Each end user has its own fuel input intensity and market output growth trajectories, and consequently its own set of fuel demand forecasts.

Table 13 displays fuel demand forecasts for each end user. The sum of these forecasts gives the NSW fuel demand forecasts contained in the forecast summary table at the front of this report.

The largest end users of fuel are households, airports, mining and the road freight transport service sector. Together, these account for nearly 90% of NSW fuel demand. The rationale and sources used to produce forecasts for these end users is as follows:

- The forecast NSW household demand for fuel is underpinned by TPA's forecast for NSW passenger vehicle sales. This is outlined in the motor vehicle section below. The key point is forecast average annual growth in NSW passenger vehicle demand (sales) does not fully translate to the same rate of forecast average annual growth in NSW household consumption of fuel. This is due to anticipated structural change in the household passenger vehicles sales market, with electric vehicles expected to account for over 20% of passenger vehicle market sales by the early 2040s. The result is that the CAGR for NSW household consumption of fuel is forecast to be 0.5% p.a. between 2016 and 2056. This compares with a forecast CAGR for NSW passenger motor vehicle demand for both fuel and electric powered vehicles of 1.1% p.a.
- The forecast of NSW airport demand for fuel is based on a combination of primary and validating sources. Firstly, a historical data series for airport usage of fuel was obtained from BITRE (Bureau of Infrastructure, Transport and Regional Economics). TPA analysed the long term historical trends in fuel usage in the BITRE data and concluded that after allowing for different GDP and tourism effects over time, the average growth in airport fuel usage has reduced gradually over time. This is most likely due to more fuel efficient airplanes gradually coming on line. This trend is expected to continue over the forecast period. TPA assumed that NSW airport fuel usage will increase at an average growth rate of 2.75% p.a. between 2016 and 2036. This is less than the historical average growth rates of 4% - 5% p.a.. Over the second half of the forecast period (2036 – 2056), TPA assumed that NSW airport fuel usage will increase at an average growth rate of 1.5% p.a..
- TPA considered short term forecasts of NSW international tourist arrivals from DAE. DAE forecasts average annual growth in tourist numbers of 3% p.a. from 2016 to 2026. This is below the average annual growth rate of 4% over the last 10 years (2006 to 2016). Once again, this provides broad support for the airport fuel usage forecast profile here.
- Overall, NSW airport demand for fuel is forecast to increase at a CAGR of 2.1% p.a. between 2016 and 2056. This translates to more than a doubling of the airport fuel demand in volume terms.

- The forecast NSW coal sector demand for fuel is underpinned by TPA's forecast coal production. This is explained in the coal section below.
- The forecast NSW road freight demand for fuel is driven by forecasts for NSW industrial production. Trends in industrial production are a reliable proxy for trends in total road freight demand. This is because industrial production is a base indicator of downstream activity, where output in the manufacturing sector (which forms the core of industrial production) feeds into mining, agriculture, construction, retail and wholesale sector output. Based on DAE and TPA assumptions, NSW industrial production is forecast to grow at 1.5% p.a. over the next 40 years. This is reflected in a forecast CAGR of 1.5% p.a. for NSW road freight industry demand for fuel.

Overall, NSW fuel demand is forecast to rise by 1.1% p.a. over the next 40 years. In volume tonnage terms, demand is forecast to rise from 11 mtpa in the base year of 2016 to 17 mtpa by 2056. This gives a total forecast increase of 54%.

Table 13: NSW fuel demand forecast, 2016 – 2056, mtpa

End user market demand driver	Primary type of fuel used	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
NSW household consumption (fuel powered passenger motor vehicles only)	Petrol	4.9	5.4	5.9	0.5%	21%
NSW coal production	Diesel	1.3	1.6	1.6	0.5%	22%
NSW metal ore production	Diesel	0.2	0.2	0.2	0.2%	11%
NSW agricultural production	Diesel	0.2	0.3	0.3	1.2%	59%
NSW road industry transport	Diesel	1.0	1.3	1.8	1.5%	85%
NSW rail industry transport	Diesel	0.3	0.3	0.3	0.5%	22%
NSW airports	Jet	2.6	4.4	5.9	2.1%	129%
NSW construction	Diesel	0.6	0.7	0.8	1.0%	47%
NSW manufacturing production	Diesel	0.2	0.2	0.3	1.0%	52%
All end user demands	**Total**	**11.2**	**14.4**	**17.2**	**1.1%**	**54%**

Source: TPA analysis, Deloitte Access Economics, BITRE Australian Infrastructure Statistics 2016 Yearbook

4.6. Motor vehicles

The motor vehicle demand forecasts reported here are unconstrained demand forecasts, reflecting end user demands independent of supply side constraints. Possible constraints include capacity limits at motor vehicle import terminals, storage yards and on the landside freight network. The presence of such constraints would reduce the forecast tonnage demand reported here.

These motor vehicle demand forecasts are for passenger motor vehicles only. Passenger motor vehicles include cars and special utility vehicles (SUVs). Forecasts for light commercial vehicles (LCVs) are covered later in this report.

The forecast demand for NSW passenger motor vehicles is based on forecast NSW household purchases of passenger motor vehicles. This is shown in Table 14. This is demand for fuel and electric powered passenger motor vehicles.

The rationale and sources used to produce the forecasts is as follows:

TPA used assumptions regarding the number of sales of motor vehicles per person in NSW and NSW population growth forecasts (taken from TPA's TZP 2016 forecasts) to produce passenger motor vehicle growth forecasts to 2056. This is fundamentally the same approach employed by BIS Shrapnel in a forecasting report it prepared for TfNSW in 2013. In that report, it was noted that NSW sales of passenger motor vehicles per person had remained fairly stable since the 1990s – at approximately 0.04 vehicles per person. There is nothing to suggest that there will be any change to this ratio over the forecast period. Therefore, TPA assumed NSW sales per person of 0.04 from 2016 to 2056. Forecast NSW sales per person were added to forecast NSW population growth (taken from TPA's TZP 2016 forecasts) to obtain forecast demand growth in passenger motor vehicles for all of NSW. This means passenger motor vehicle volumes have been forecast to grow in line with NSW population growth over the forecast period.

NSW passenger motor vehicle demand is forecast to grow at a CAGR of 1.1% p.a. over the next 40 years and rise from 0.31 million units in the base year of 2016 to 0.50 million units by 2056. This gives a total increase of 56%.

Table 14: NSW passenger motor vehicle demand forecast, 2016 - 2056

End user market demand driver	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
NSW household consumption (million units)	0.3	0.4	0.5	1.1%	56%
NSW household consumption (million tonnes)	**0.7**	**0.9**	**1.1**	**1.1%**	**56%**

Source: TPA analysis, TZP 2016 forecasts, BIS Shrapnel 'Port Kembla Commodity Forecasts' report for TfNSW Bureau of Freight Statistics July 2013

In order to determine NSW household fuel demand, the forecasts of passenger motor vehicle demand had to be broken down into demand for fuel and electric powered motor vehicles. (Table 15).

TPA assumed the electric vehicle share of total passenger motor vehicle demand is forecast to rise from 0% in 2016 to 13% in 2036. From there, the share is forecast to reach 22% by 2041. An unchanged share of 22% was assumed over the remainder of the forecast period to 2056.

Table 15: NSW passenger motor vehicle demand forecasts by power source, 2016-2056, million units

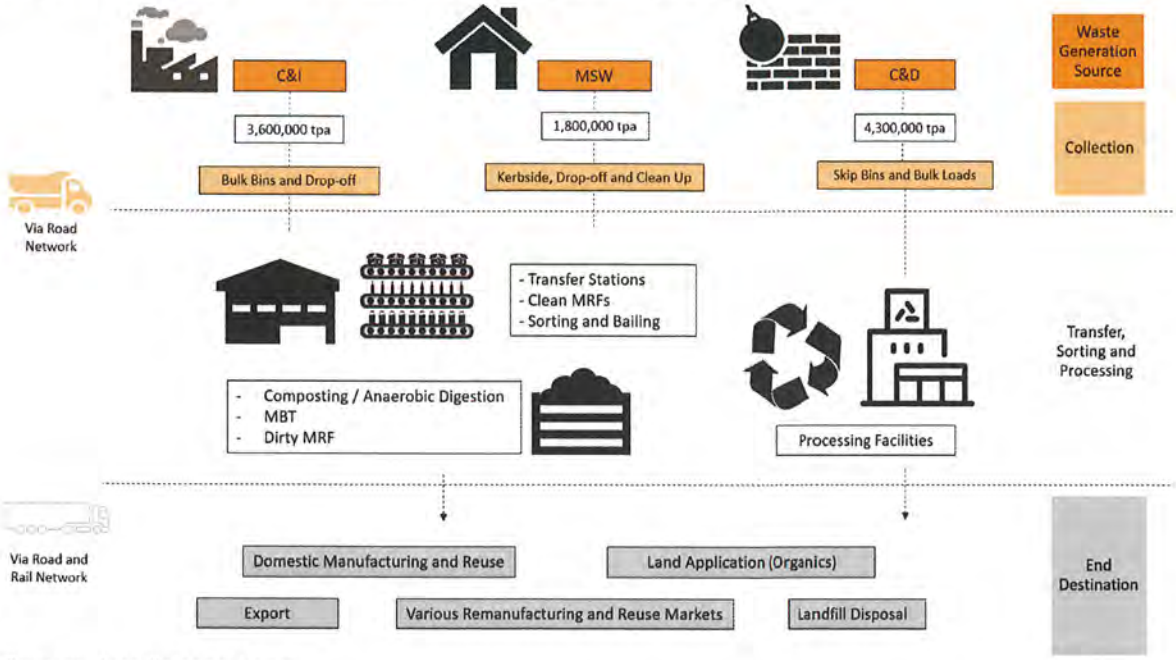
Vehicle power source	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Fuel and electric	0.32	0.41	0.50	1.1%	56%
Fuel	0.32	0.36	0.39	0.5%	21%
Electric	0.00	0.05	0.11	58.9%	NA
Fuel % share	100.0%	87.0%	77.5%	NA	NA
Electric % share	0.0%	13.0%	22.5%	NA	NA

Source: TPA analysis

4.7. Waste

The overall supply chain for waste processing and recycling is shown in Figure 11.

Figure 11: Supply chain for waste processing and recycling



Source: Arcadia consultants

The current volumes of waste in the three major categories were estimated as follows.

- Municipal Solid Waste (MSW) estimates were modelled on 2014-15 Waste and Resource Recovery (WARR) data for kerbside, drop-off and clean up waste;
- Commercial and Industrial (C&I) waste estimates were modelled using Pilot Generator Site-based Audit for C&I waste and the Disposal-Based Audit to determine generation per Full-time Equivalent (FTE) in key industry types (ANZSIC codes); and
- Base year (2016-17) figures were derived from applying the GSP growth rate to the waste generation per capita for the travel zones for Sydney, Hunter and Illawarra applied.

Future projections for the waste types were determined as follows:

- MSW projections based on constant number of tonnes of waste per capita;
- C&I projections based on fixed number of tonnes per employee; and
- Construction and Demolition (C&D) projections based on constant number of tonnes of waste per capita.

Table 16: NSW waste demand forecast, 2016 – 2056, mtpa

Type of waste	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
MSW	2.73	3.85	4.81	1.4%	76%
C&I	3.89	5.26	6.44	1.3%	66%
C&D	6.04	8.87	11.13	1.5%	84%
Total	**12.6**	**18.0**	**22.4**	**1.4%**	**77%**

Source: TPA analysis, Arcadia consultants

4.8. Light Commercial Vehicle (LCV)

The numbers of LCVs registered in NSW at January 2016 are shown in Table 17. The fact that 32.6% of vehicles registered were registered within the last 5 years, indicates strong growth in the vehicle fleet.

Table 17: NSW LCV by year of registrations, Jan 2016

Year	Number of vehicles	Proportion (%)
To 2000	178,547	22.2%
2001 – 2005	156,327	19.4%
2006 – 2010	207,302	25.8%
2011 – 2016	262,489	32.6%
Total	**804,665**	**100.0%**

Source: TPA analysis, ABS 93090DO001_2016 Motor Vehicle Census, Australia, 31 Jan 2016

The methodology for estimating LCV movements is based on LCV attraction rates i.e. the rate of attraction of LCVs to (1) households and (2) businesses, measured by the number of employees. These attraction rates were applied to the number of households and number of employees in each travel zone to obtain the total number of LCVs attracted to the zone.

The forecasts of LCV movements are produced by:

- Calculating future zonal trip ends based on household and employment forecasts. Both household and business LCV attraction rates are assumed to be constant in future years; and
- Using the Fratar[3] method to forecast future trip tables based on zonal growth factors and the base 2006 trip table.

[3] Growth model which did not differentiate trips by purpose

5 Regional NSW

This section sets out demand forecasts for mineral, agricultural and manufacturing based commodities typically originating in regional NSW and how they were arrived at. This includes:

- Coal
- Non coal minerals
- Grain
- Edible oils, livestock meals and oilseeds (canola seed and cottonseed)
- Livestock
- Red meat
- Steel
- Cotton lint
- Forestry
- Horticulture
- Dairy
- Wine

Charts give a sense of the forecast origins and destinations for particular commodities.

5.1. Coal

The coal demand forecasts reported here are unconstrained demand forecasts, determined by end user demand independent of supply side constraints. Possible constraints include the level of reserves and capacity limits at mine sites, export terminals and on the landside freight network. The presence of such constraints would reduce the forecast tonnage demand reported here.

These forecasts are for black thermal and coking (or metallurgical) coal.

TPA identified four end user demand drivers of NSW coal demand. Thermal coal is demanded by domestic and international power stations to generate electricity for consumption by households and businesses. Coking coal is demanded by domestic and international steel manufacturers to make steel which is used in building and infrastructure construction.

Table 18 displays the forecast profiles for each end user. The sum of these gives the NSW coal demand forecasts contained in the forecast summary table at the front of this report.

The largest end user demand driver by far is international electricity generation. In the base year of 2016, approximately 140 mtpa, or almost 75% of total NSW coal demand, was related to the export of NSW thermal coal to power station customers in Japan, South Korea, China, Taiwan and India.

Table 18: NSW coal demand forecast, 2016 – 2056, mtpa

Type of coal	End user market demand driver	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Thermal	Domestic electricity generation	23	24	21	-0.3%	-10%
Thermal	International electricity generation	139	149	158	0.3%	13%
Coking	Domestic steel production	3	3	5	1.5%	81%
Coking	International steel production	25	33	47	1.6%	90%
Total	**All end user demands**	**189**	**210**	**230**	**0.5%**	**21%**

Source: TPA analysis

Thermal coal: exports

TPA based its forecasts on forecasts produced by the Institute of Energy Economics of Japan (IEEJ). In 2015, the IEEJ published long term coal consumption and production forecasts for the five countries of relevance to NSW: Japan, South Korea, China, Taiwan and India. The basis of the forecasts is considered to be sound, as it takes into account future economic growth, energy intensity of industry and government energy policy settings (such as government incentives for industry to invest in and adopt clean energy sources and construction of more coal efficient power stations).

TPA subtracted the coal production forecasts from the coal consumption forecasts to obtain coal import forecasts by country.

Table 19 displays the forecast CAGRs for coal imports by country. It shows either flat or declining growth for coal imports in four of the five countries.

China is one of these countries. In stark contrast to the last 20 years, Chinese coal imports are predicted to increase slightly over the next 20 years before levelling off thereafter.

This reflects the impact of government renewable energy policy and substantially lower growth in domestic construction and manufacturing activity as the economy transitions to a more balanced mix of manufactured goods production and consumption of services.

India is the only large country in Asia that is anticipated to experience a solid growth in coal imports over the long term.

The fundamental demand driver behind this is the need for Indian governments to provide thermal coal-generated electricity to the large proportion of its population currently living without electricity. In addition, Indian supplies of thermal coal are generally considered to be of sub-standard quality for electricity generation.

Table 19: Key country coal import demand forecast growth, 2016 – 2056

Country	2016 – 2036 – Forecast CAGR %	2036 – 2056 – Forecast CAGR %
Japan	-0.5%	-0.6%
China	0.6%	-0.1%
South Korea	0.5%	0.2%
Taiwan*	0.5%	0.2%
India	4.0%	3.5%

Source: TPA analysis, Institute of Energy Economics of Japan (IEEJ), 'Long Term Trends and Outlook for Global Coal Supply and Demand, 2015. * No forecasts were available from IEEJ for Taiwan. TPA assumed forecast growth for Taiwan to be the same as South Korea due to similar levels of industrialisation and living standards.

TPA used the above forecasts to determine NSW thermal coal export forecasts to 2056. A simplifying assumption was made that a particular percentage change in Asian coal imports would translate to the same corresponding percentage change in demand for NSW thermal coal exports.

Table 20 displays the resulting forecast tonnages and CAGRs. The overall demand outlook for NSW thermal coal exports is expected to be subdued. This is primarily because NSW's largest customers for thermal coal, Japan and China, are predicted to either experience flat or declining import demand for thermal coal.

While NSW thermal coal exports to India are expected to grow significantly, this growth is coming off a very low base. Therefore, in overall terms, only slight CAGR growth is expected over the next 40 years.

Table 20: Key country destinations for NSW thermal coal export demand forecasts, 2016 – 2056, mtpa

Destination country	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Japan	63	56	50	-0.6%	-20.6%
China	32	36	35	0.2%	9.5%
South Korea	24	26	27	0.3%	14.0%
Taiwan	14	15	16	0.3%	14.0%
India	7	15	30	3.7%	330.6%
Total	**139**	**149**	**158**	**0.3%**	**13.2%**

Source: TPA analysis, Aurizon 'The Future of Coal', 2015 Sustainability Report

The major origin-destination demands for coal exports are displayed in Figure 12 below. These represent 86% of total export demand.

Figure 12: Key coal origins-destinations for international export demand, 2036 forecast

Source: TPA analysis

Apart from the thermal coal export demand forecasts, another notable aspect of the coal demand forecasts is the outlook for domestic thermal coal.

Thermal coal: domestic

Demand for NSW thermal coal from domestic power stations is forecast to fall by approximately 10% over the next 40 years. TPA based this forecast on the broad consensus contained in a number of credible reports, including:

- Australian Energy Market Operator, 'National Electricity Forecasting Report for the National Electricity Market', June 2016;
- Bureau of Resources and Energy Economics, 'Australian Energy Projections to 2049-50', November 2014; and

- AGL, 'National Electricity Forecasting Report 2016' (Chapter 5: Discussion of Key Trends and Drivers), 2016.

The main reasons for the forecast gradual decline in coal demand from domestic power stations are similar to those driving the decline in demand in Japan, South Korea and China.

Figure 13 contains the key origin-destination demands for coal, related to NSW power station demands. These represent 100% of demand for this end user.

Figure 13: Key coal origins-destinations for NSW powerstation demand, 2036 forecast

Source: TPA analysis

Figure 14 contains the origin-destination demands for coal, representing flows for NSW steel manufacturer demand.

Figure 14: Key coal origins-destinations for NSW steel manufacturer demand, 2036 forecast

Source: TPA analysis

5.2. Non-coal minerals

Non-coal minerals are naturally occurring, inorganic solids that are mined at commercially viable sites. In the context of NSW, this includes:

- Copper
- Rutile
- Zinc
- Lead
- Silver

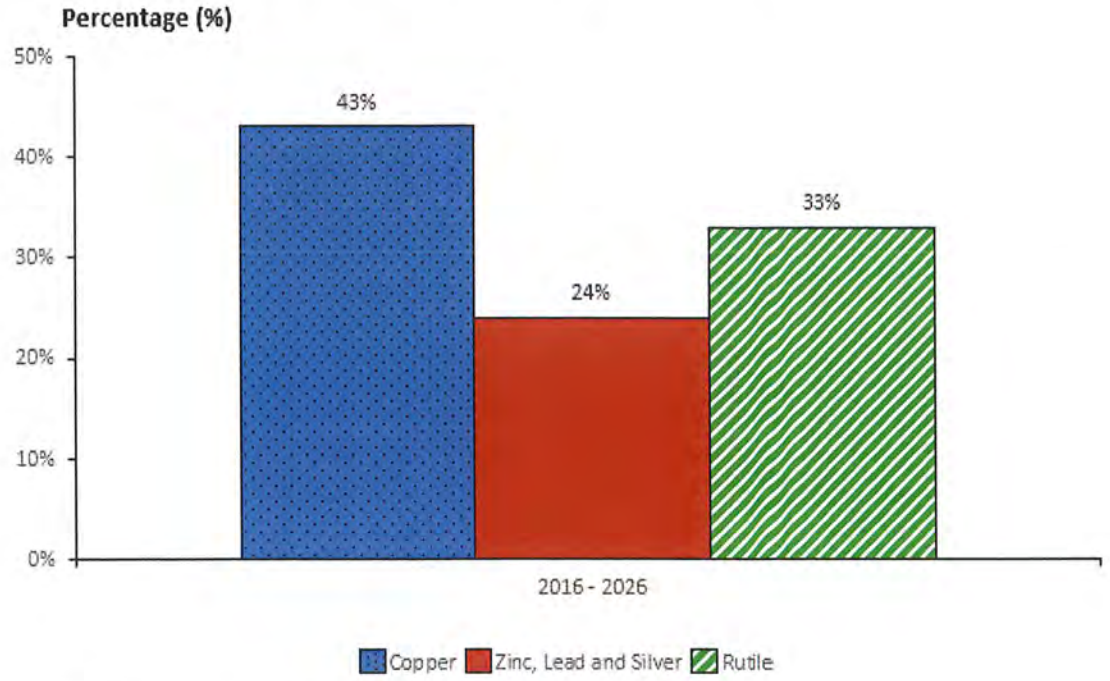
Non-coal minerals are essential components of metal products, steel, electrical wiring and plumbing.

TPA estimates that 2.4 million tonnes of non-coal minerals were produced in the base year of 2016, from 9 mines across NSW.

The overwhelming majority of NSW non-coal mineral production is exported to major trading partners in Asia, where it feeds into various industrial manufacturing processes.

Copper and rutile account for around 75% of NSW non-coal mineral production volumes (see Figure 15). This estimate is based on mine operator reports and previous TPA analysis using data from the Sydney Trains' Train Running Information Management System (TRIMS) database .

Figure 15: NSW non coal mineral volumes by type of mineral, 2016



Source: TPA analysis, various company reports

Non-coal minerals are mostly moved by rail with some exceptions for mines in the Broken Hill and Murray Basin.

TPA generated demand forecasts for NSW non-coal minerals are shown in Table 21.

Table 21: NSW non coal mineral demand forecasts, 2016–2056, mtpa

End user market demand driver	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Asian industrial production*	2.4	2.4	2.4	0%	0%

Source: TPA analysis. * The forecast of 0% p.a. growth here is consistent with the containerised mineral ores and metals export forecast growth rate as shown in the Port Botany export container section in this report.

Historically there has been a weak negative relationship between NSW non-coal mineral production and Asian industrial production. This is reflected in the fact that sustained growth in urbanisation in China (and its implications for Chinese steel, copper and wire production) has not consistently translated into sustained growth in Australian exports of copper concentrates. Copper concentrates volumes have actually fluctuated quite dramatically.

Mine specific factors, such as productivity and reserves, are considered to be the key drivers of production. This is because there are an insufficient number of mines in NSW to respond to market demand signals.

TPA has assumed that NSW non-coal mineral demand will remain at current levels to 2056. This reflects the unpredictable nature of non-coal mineral production. It is expected that some mines will increase their production volumes, while others will reduce production volumes over the forecast period. Similarly, new mines will come on line while others will close over the forecast period.

Figure 16 displays the origin-destination demands for non-coal mineral exports. These flow to ports in NSW and South Australia.

Figure 16: Key non-coal mineral origins-destinations for domestic and international export demand, 2036 forecast

Source: TPA analysis

5.3. Grain

The grain demand forecasts reported here are unconstrained demand forecasts, determined by end user demand for grain independent of supply side constraints. Possible constraints include the available plantation area, yield and capacity limits in on-farm storage, grain silos, export terminals and on the landside freight network. The presence of such constraints would reduce the forecast tonnage demand reported here.

These forecasts are for wheat, coarse grains (barley, oats, sorghum, maize and triticale) and pulses (lupins, field peas, chickpeas, faba beans, mung beans).

TPA identified four drivers of end user demand for NSW grain. These are:

- Domestic feedlots: grain is fed to chickens, pigs, sheep and cattle;
- Domestic flour and industrial product mills: grain is used to manufacture flour, which in turn is used to produce bread, biscuits, pasta and pastries. Grain is also used to produce industrial grade flour, which in turn is used to manufacture industrial starches, glucose syrups and ethanol products;
- Bulk export: grain is sold overseas in bulk form; and
- Containerised export: grain is packed into containers and sold overseas, increasingly to meet demand from wealthy Asian customers seeking out high value, specialty grains.

Domestic feedlots and mills show long established and stable demand patterns, and have the first call on grain production. Bulk grain exports are met from residual supply and generally fluctuate with levels of grain production.

Table 22 displays NSW grain demand forecasts by each end user to 2056.

Table 22: NSW grain demand forecasts, 2016 – 2056, mtpa

Parcel type	End user market demand driver	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Bulk	Domestic feedlots	1.8	2.5	3.1	1.4%	76%
Bulk	Domestic human food and industrial production	2.8	3.7	4.5	1.1%	56%
Bulk	International human food production	2.6	2.7	3.2	0.5%	22%
Containerised	International human food production	1.1	1.7	2.2	1.6%	91%
Total	**All end user demands**	**8.4**	**10.6**	**12.9**	**1.1%**	**56%**

Source: TPA analysis, NSW Department of Primary Industries, GrainCorp

The rationale and sources used to produce forecasts for these end users is as follows:

Forecast NSW domestic feedlot demand for bulk grain is underpinned by TPA's livestock forecasts contained in the livestock section below. The forecast CAGR is 1.4% p.a. between 2016 and 2056.

The key origins and destinations for bulk grain exports are displayed in Figure 17 below. These capture 90% of the market.

Figure 17: Key bulk grain origins-destinations for domestic feedlot demand, 2036 forecast

Source: TPA analysis

Forecast NSW food and industrial demand for bulk grain is assumed to grow in line with forecast growth in NSW population. TPA's TZP 2016 forecasts the NSW population to grow at 1.1% p.a. between 2016 and 2056.

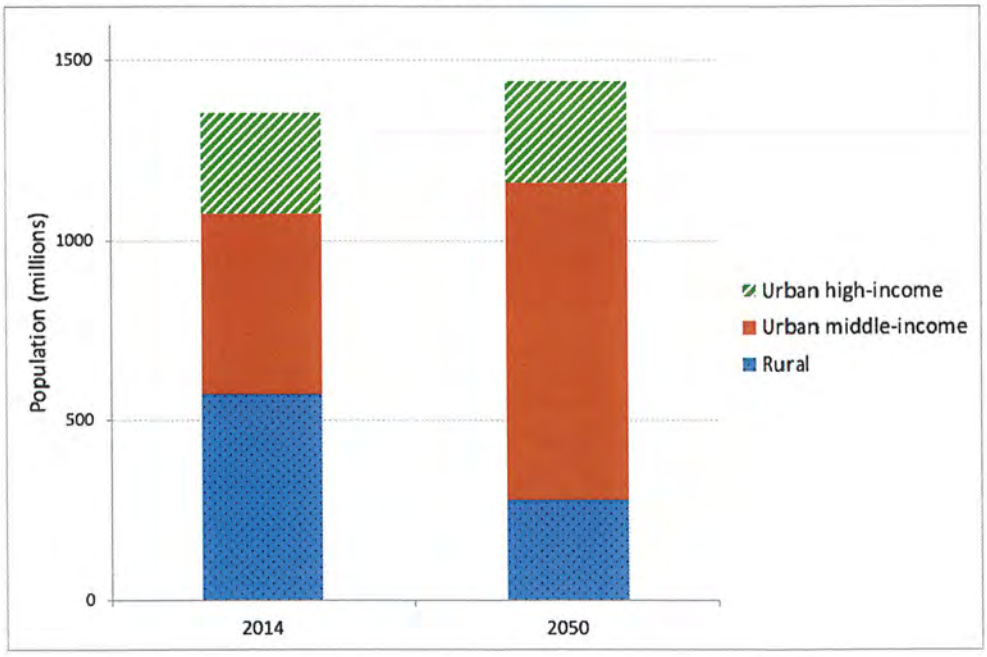
Figure 18 depicts the major origins and destinations for grain for domestic food and industrial production. This captures 71% of movements for this demand end user.

Figure 18: Key bulk grain origins-destinations for domestic human food and industrial demand, 2036 forecast

Source: TPA analysis

Of the four end user demand categories, NSW containerised grain export demand for human food production is expected to record the strongest growth. TPA assumed forecast growth of 2% p.a. from 2016 to 2036, and 1.25% p.a. from 2036 to 2056. This is based on information provided to TPA by the NSW Department of Primary Industries. This is consistent with forecast growth in size of the Asian middle class. Using China as an example, Figure 19 provides a glimpse of the extent to which the size of the Chinese middle class is expected to grow over the next 30-40 years. This bodes well for high value specialty NSW containerised grain export demand.

Figure 19: Forecast income trends in China



Source: United Nations (2011), ABARES Outlook 2012

Figure 20 displays the key origin-destination demands for containerised grain exports. These capture the entire containerised grain export market.

Figure 20: Key container grain origins-destinations for international export demand, 2036 forecast

Source: TPA analysis

Forecast NSW bulk grain export volume demand is assumed to grow at a CAGR of 0.5% p.a. between 2016 and 2056.

Figure 21 displays the major origin-destination demands for bulk grain exports. These capture 90% of movements, going into the Port of Newcastle and Port Kembla.

Figure 21: Key bulk grain origins-destinations for international export demand, 2036 forecast

Source: TPA analysis

5.4. Oils, meals and oilseeds

5.4.1. Edible oils and livestock meals

In this section the term oils is used to refer to edible oils for human consumption, such as vegetable and cooking oils.

Meals are defined as foods for livestock (or animal) consumption.

In NSW, oils and meals are processed from two key types of oilseed: canola seed and cottonseed.

Whilst there are other types of oilseeds like linseed, safflower seeds and sunflower seeds; NSW production volumes for these have been relatively small. Historically, these seeds have been used sporadically as temporary substitutes for canola seed and cottonseed, when their production levels have been adversely affected by bad weather.

Canola seed and cottonseed are delivered from farms and gins (in the case of cottonseed) to crushing plants, where the raw oil is extracted. The raw oil is then transferred to oil refining facilities. Meals are by-products of the oilseed crushing process. Raw and refined meals are produced at crushing plants, but raw meals can also be transferred to specialist meal manufacturers for further value adding.

The production of oils and meals, by end users, are depicted in Table 23 below.

Table 23: NSW oil and meal demand forecasts, 2016–2056, mtpa

Type of oil and meal	End user market demand driver	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Canola oil	Domestic human food production	0.1	0.1	0.2	1.1%	56%
Canola oil	International human food production	0.1	0.1	0.1	1.7%	91%
Canola meal	Domestic livestock feedlots	0.3	0.5	0.6	1.4%	76%
Canola meal	International livestock feedlots	0.1	0.1	0.1	1.4%	76%
Cottonseed oil	Domestic human food production	0.1	0.1	0.1	1.1%	56%
Cottonseed oil	International human food production	0.0	0.0	0.0	1.7%	91%
Cottonseed meal	Domestic livestock feedlots	0.3	0.3	0.4	1.4%	76%
Cottonseed meal	International livestock feedlots	0.0	0.0	0.0	1.4%	76%

Canola and cottonseed oil	**All end user demands**	**0.2**	**0.3**	**0.4**	**1.3%**	**67%**
Canola and cottonseed meal	**All end user demands**	**0.6**	**0.9**	**1.1**	**1.4%**	**76%**

Source: TPA analysis
*Due to rounding at the one decimal place level, some values appear indeterminate at 0.0. For more specific values, see the underlying commodity forecast spreadsheets, which are listed at the three decimal place level

Imports

TPA has sourced Port of Newcastle trade data that shows meal imports through the Port of Newcastle. Whilst previous analysis has shown that meal imports are not canola or cottonseed meals, but soybean meals, they have been included in this analysis because their volumes are notable.

Soybean meals are driven by demand from chicken feedlots. This import demand is assumed to grow in line with domestic chicken feedlot demand. The end user forecasts are shown in Table 24.

Table 24: Meal imports end user forecasts, 2016–2056, mtpa

	End user market demand driver	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Soybean imports	Domestic feedlots	0.1	0.2	0.2	1.4%	76%

Source: TPA analysis

5.4.2. Oilseeds (canola seed and cottonseed)

The main difference between canola seed and cottonseed is that cottonseed can be fed directly to livestock, as well as in the form of cottonseed meal. Canola seed is generally not fed directly to livestock.

Total production by NSW region for canola seed and cottonseed is listed in Table 25 below.

Table 25: NSW canola seed production by region, 2016, mtpa

NSW region	Canola seed	Cottonseed
Northern	0.1	0.3
Western	0.3	0.1
Southern	0.4	0.1
Total NSW	**0.8**	**0.6**

Source: TPA analysis

End user demand drivers

Canola seed is demanded by domestic processors (who process the seed into meals, which are then consumed by livestock at domestic feedlots or exported), and international processors (who process the seed into meals, which is then consumed by livestock in their domestic feedlots).

End user demand drivers for cottonseed include domestic feedlots (where seed is fed in raw form to livestock), domestic processors (who process it into protein based cottonseed meals that are consumed by livestock at domestic feedlots or exported) and overseas users (where cottonseed is sent to international feedlots and/or processors to make meals).

The end user demands for the base year are listed in Table 26 below.

Table 26: Drivers of NSW canola seed and cottonseed demand, 2016, mtpa

End user market demand driver	Destination	Canola seed	Cottonseed
NSW processors	NSW	0.4	0.3
NSW exports	Port of Newcastle	0.1	0.0
NSW exports	Port Kembla	0.2	0.0
NSW exports	Port Botany	0.0	0.1
NSW feedlots	NSW	0.0	0.1
Interstate demand	Interstate	0.1	0.0
All end user demands	**Total**	**0.8**	**0.6**

Source: TPA analysis

Forecast volumes

The forecast volumes for canola seed and cottonseed, by end user, are depicted in Table 27 below.

Table 27: NSW canola seed and cottonseed demand forecasts, 2016 – 2056, mtpa

Oilseed type:	End user market demand driver	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase (2016-2056)
Canola seed	Domestic canola meal production	0.5	0.7	0.9	1.3%	70%
Canola seed	International canola meal production	0.2	0.2	0.3	0.5%	22%
Sub-total	All end user demands	0.8	1.0	1.2	1.1%	56%
Cottonseed	Domestic livestock feedlots	0.1	0.2	0.3	1.3%	71%
Cottonseed	International canola meal production	0.3	0.4	0.5	1.4%	74%
Cottonseed	International livestock feedlots or cottonseed meal production	0.1	0.1	0.1	0.5%	22%
Sub-total	All end user demands	0.6	0.7	0.9	1.2%	64%
Canola seed and cottonseed	**All end user demands**	**1.3**	**1.7**	**2.1**	**1.2%**	**58%**

Source: TPA analysis

5.5. Cotton lint

Raw cotton is delivered from farms to ginning processing facilities, where the lint (or fibre) is separated from the seed. Lint is used by cotton spinners and textile companies to manufacture lint-based clothing garments and fabrics, while the seed (as outlined in the oilseeds section of this report) is used to manufacture vegetable/cooking oil, livestock meals or directly feed to livestock.

All cotton lint production volumes originating from NSW gins are exported to international textile manufacturers.

TPA obtained information about the forecast outlook for cotton lint exports from the DPI. The consensus was that global cotton lint demand is expected to grow at a consistent rate of approximately 1.4% p.a. over the long term. This is broadly in line with the average annual historical growth rate in global demand.

In the base year of 2016, TPA has estimated the NSW cotton lint demand to be 0.4 million tonnes. This is the average of annual volumes observed since the early 1990s. This approach to estimating cotton lint demand in 2014 has been taken because cotton production volumes are usually highly variable from year to year, (like other agricultural commodities such as grain), due to variations in rainfall.

A forecast growth rate of 1.4% has been applied to the 2016 volume to generate a forecast profile out to 2056. Table 28 shows a demand forecast of 0.7 million tonnes by 2056.

Table 28: Cotton lint demand forecast, 2016 – 2056, mtpa

End user demand driver	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase (2016-2056)
International textile demand	0.4	0.5	0.7	1.4%	76%

Source: TPA analysis, consultation with DPI, ABARES 'Agricultural Commodities March 2017'

Figure 22 displays the major origin-destination demands for international cotton lint exports.

Figure 22: Key cotton lint origins-destinations for international export demand, 2036 forecast

Source: TPA analysis

5.6. Livestock

Total livestock demand consisting of cattle and sheep in NSW is estimated at 1.4 million tonnes (on live animal weight basis) in 2016. This is forecast to increase to 3.1 million tonnes in 2036 and to 3.9 million tonnes in 2056. These numbers have been derived taking into account herd size and the time required for rebuilding stock.

The livestock demand forecasts reported here are determined by end user demand independent of supply side constraints. Possible constraints include maximum herd size and capacity limits on the landside freight network. The presence of such constraints would reduce the forecast tonnage demand reported here.

Table 29 shows domestic meat production by abattoirs is the end user driver of demand for livestock. NSW livestock demand is forecast to increase at a solid CAGR of 2.6%. This is attributable to the following:

- In 2016, approximately 3,400 NSW cattle and sheep were slaughtered, which is well below the historical annual average of 5,800. TPA has assumed that the numbers of livestock slaughtered will increase over the next few years to reach the historical annual average by 2021. The demand driver is increased overseas demand which has resulted in rapidly rising prices for beef and lamb at the domestic retail level over the last few years.
- After reaching the historical annual average of slaughters by 2021, two different markets impact upon livestock demand.
- The first is livestock for domestic meat production sold into the domestic market. This is assumed to grow in line with NSW population growth until 2056. This gives a forecast CAGR of 1.1% p.a. between 2021 and 2056.
- The second is livestock for meat production sold into the international export market. This is assumed to increase by 1.5% p.a. between 2021 and 2056. TPA's research and information received from the DPI suggests that the export demand will outstrip domestic demand over the long term. This is due to the rising prominence of the middle class in Asia, as outlined in the grain section above.
- By 2056, approximately three quarters of livestock slaughtered will serve export market demand, while the remaining quarter will meet domestic market demand.

Table 29: NSW livestock demand forecasts, 2016–2056, mtpa

End user market demand driver	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Domestic meat production	1.4	3.1	3.9	2.6%	177%

Source: TPA analysis, NSW Department of Primary Industries, World sheep meat market to 2025, Agriculture and Horticulture Development Board and International Meat Secretariat 2015.

Figure 23 displays the major origin-destination demands, for livestock demanded by domestic abattoirs. These represent 63% of total movements for this end user demand.

Figure 23: Key livestock origins-destinations for domestic abattoir demand, 2036 forecast

Source: TPA analysis

5.7. Red meat

The red meat (processed beef and lamb) demand forecasts reported in Table 30 are unconstrained demand forecasts. The CAGR and total % increase forecasts are the same as for the NSW livestock forecasts. The only difference is that for meat, the end user demand is consumption, whereas for livestock the end user demand is processing.

Total red meat demand is estimated to be 0.6 million tonnes per year in 2016. This is forecast to increase to 1.3 million tonnes by 2036 and to 1.6 million tonnes by 2056. The demand growth will be driven by the strong growth in international markets (with CAGR of 3.4%) and slightly slower growth in domestic market (1.3%).

Table 30: NSW red meat demand forecasts, 2016–2056. mtpa

End user market demand driver	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Domestic meat consumption	0.3	0.4	0.5	1.3%	69%
International meat consumption*	0.3	0.9	1.1	3.4%	274%
All end user demands	**0.6**	**1.3**	**1.6**	**2.6%**	**175%**

Source: TPA analysis, NSW Department of Primary Industries, World sheep meat market to 2025, Agriculture and Horticulture Development Board and International Meat Secretariat 2015. * The forecast growth for containerised meat exports here is consistent with that shown in the Pot Botany container exports section of this report.

5.8. Steel

Raw steel is mostly in the form of steel slabs, plates and coils. Finished steel encompasses a large range of coated, painted and structurally reinforced products like steel sheets, bar, wire, mesh, pipes, rods and posts. Raw steel is characterised as lower value and semi-processed while finished steel is higher value and highly processed. Finished steel products are usually processed from raw steel and other inputs such as steel scrap.

In 2016, demand for NSW steel was estimated at approximately 3.8 million tonnes.

TPA identified five key end user drivers that consistently underpin NSW steel demand volumes. These are:

- Domestic construction: In 2016, new construction activity accounted for around 70% of NSW steel demand, with steel required across a wide range of applications in three key types of construction; residential, non-residential and infrastructure;
- Domestic mining sector: Mining production requires steel grinding bar which is the feed for grinding media. Grinding media is used to extract particles from mineral ores and to pulverise coal. The mining sector is a relatively small end user of steel (accounted for approximately 5% of NSW steel demand in 2016);
- Domestic agriculture sector: Steel wire and posts are used for fencing, pipes for irrigation systems and sheets for sheds and storage tanks. The agriculture sector is a relatively small end user of steel (accounting for approximately 5% of NSW steel demand);
- Domestic manufacturing sector: Steel is used to manufacture spare parts and components, specialised machinery and transport equipment. The manufacturing sector accounts for approximately 12% of NSW steel demand; and
- International export: This mostly comprises raw steel which is exported from Port Kembla to international steel manufacturers for further processing. In 2016, this accounted for approximately 18% of NSW steel demand.

Forecast growth rates for the above end user demands are as follows:

- Construction sector: 1.1% p.a. between 2016 and 2056. This is based on the construction materials forecasts in Table 6;
- Mining sector: 0.5% p.a. between 2016 and 2056. This is based on a combination of the coal and non-coal mineral forecasts in Table 18 and Table 21;
- Agriculture sector: 1.1% p.a. between 2016 and 2056. This is based on the grain forecasts in Table 22. Since grain represents a substantial share of total agriculture activity TPA assumed the grain forecasts are a reliable proxy for the agriculture forecasts; and
- Manufacturing sector: 1.7% p.a. between 2016 and 2056. This is based on the general manufacturing forecasts in Table 4.

Using the construction materials, mining, agriculture and manufacturing forecasts from other parts of this report ensures there is internal consistency in how the steel demand forecasts have been prepared.

- International exports were assumed to fall to zero over the long run. This is due to strong international competition in the raw steel market.

Table 31 displays the resultant forecasts for each end user and for NSW as a whole. NSW steel demand is forecast to increase by 0.7% p.a. from 3.8 million tonnes in 2016 to 5.0 million tonnes in 2056.

Table 31: NSW steel demand forecast, 2016 – 2056, mtpa

End user market demand driver	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase (2016-2056)
Domestic construction	2.3	2.9	3.6	1.1%	54.9%
Domestic mining	0.2	0.2	0.2	0.5%	22.1%
Domestic agriculture	0.2	0.2	0.3	1.1%	54.9%
Domestic manufacturing	0.4	0.6	0.9	1.7%	96.3%
Export*	0.7	0.3	0.0	-100.0%	-100.0%
All end user demands	**3.8**	**4.4**	**5.0**	**0.7%**	**29.9%**

Source: TPA analysis. * This is break-bulk steel exports through Port Kembla. This is separate to the containerised steel scrap export forecast as shown in the Port Botany container exports section of this report.

5.9. Forestry

In 2016 hardwood production in NSW totalled 876,000m^3 and was concentrated in the North Coast region. Softwood production totalled 4,651,000m^3, with key production areas including the Central Tablelands and Murray Valley (ABARES 2017).

The vast majority of forest products are transported by road (truck), with a typical maximum economic road haulage distance from forest to mill of around 200km. This concentrates log and woodchip road haulage activities around major wood processing facilities. High quality hardwood sawlogs are typically used for products such as flooring and decking, whereas low quality or salvage grade sawlogs are used for products such as pallets and fencing.

The Forestry Corporation of NSW (FCNSW) supplies pulp logs to a high density fibre board producer on the North Coast and to a woodchip processor on the South Coast. Softwood sawlogs are primarily used for housing frame construction and treated outdoor products such as decking and fencing materials, while lower grade softwood tends to be used for paper and board products.

Unlike the production of most agricultural commodities, which can fluctuate each year (sometimes significantly) depending on seasonal and market conditions, the timing of forest harvests can be managed to match supply to market demand.

This means that the supply of forest products tends to be relatively stable from year to year and the result of production decisions may have a significant time lag. The Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES; 2016) has developed medium and long-term production outlooks for Australia's National Plantation Inventory (NPI) regions. Their key findings are as follows:

- Softwood production in the Northern Tablelands is forecast to peak during the period 2015-19 at 529,000m^3, before declining by 50% and remaining relatively stable over the medium to long term.
- North Coast production is forecast to fluctuate over the medium to long term, ranging between 330,000 and 845,000m^3 per annum, in line with hardwood harvesting cycles.
- Production from the Central Tablelands is forecast to be stable over the medium to long term, at around 1.2 million cubic metres per annum.
- Southern Tablelands production is forecast to peak during the 2035-39 period at 341,000m^3, driven by softwood sawlog production, before returning to more 'average' levels (143,000 to 205,000m^3) for the remainder of the forecast period.
- Murray Valley production is forecast to peak during the 2035-39 period at 4,342,000m^3, driven by softwood sawlog production, before returning to more 'average' levels for the remainder of the forecast period.

Population growth is a key driver of forest product demand, particularly in relation to new dwelling commencements.

Estimated NSW wood product consumption over the medium and long term, based on national forecasts by ABARES (2013), suggests demand for wood-based panels and paper and paperboard will grow by more than 85% over the period (2010-14 to 2045-49), with more modest growth (13%) forecast for sawn wood consumption. It is anticipated that road freight demand will continue to grow in line with forest product demand.

Table 32: NSW log demand, 2016–2056, mtpa

Type of log	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Hardwood	0.5	0.2	0.6	0.29%	12%
Softwood	2.7	3.1	2.6	-0.09%	-3%
Total end user demands	**3.2**	**3.4**	**3.2**	**0.00%**	**-1%**

Source: TPA analysis

Figure 24 depicts the origin-destination demands for logs, in terms of international export demand.

Figure 24: Key log origins-destinations for international export demand, 2036 forecast

Source: TPA analysis

Figure 25 displays the key origin-destination demands for logs demanded by domestic sawmills.

Figure 25: Key log origins-destinations for domestic sawmill demand, 2036 forecast

Source: TPA analysis

Figure 26 displays the key origin-destination demands for logs demanded by paper, pulp and other mills.

Figure 26: Key log origins-destinations for paper, pulp and other and mill demand, 2036 forecast

Source: TPA analysis

5.10. Horticulture

Horticulture production in NSW is estimated at 0.8 million tonnes in FY 2016, consisting of key fruits (0.47 million tonnes), vegetables (0.3 million tonnes) and nuts (about 35,000 tonnes).

About 90% of fresh fruits and vegetables is supplied fresh to domestic markets; about 7% is processed, with a small fraction exported. About 80% of nuts grown in NSW is processed domestically, with the remaining 20% exported. All horticulture production is trucked for domestic distribution.

Inter-state imports of horticulture products are estimated at around 0.6 million tonnes. Thus, the total volumes distributed in NSW add up to 1.5 million tonnes. In addition, it is also estimated that about 63,000 tonnes of horticulture products were imported into NSW in FY 2015.

Table 33 provides estimates of demand in the horticulture sector.

Table 33: NSW horticulture demand, 2016

Key commodities	End user market demand driver	Mpta
Fruits	Fresh market supply	0.40
Fruits	Processing	0.04
Fruits	Exports	0.03
Fruits	Sub-total	0.47
Vegetables	Fresh market supply	0.27
Vegetables	Processing	0.01
Vegetables	Exports	0.01
Vegetables	Sub-total	0.30
Nuts	Fresh market supply	0.00
Nuts	Processing	0.03
Nuts	Exports	0.01
Nuts	Sub-total	0.04
NSW total production		0.8
Inter-state transfer	Victoria	0.25
Inter-state transfer	Qld	0.19
Inter-state transfer	South Australia	0.13
Inter-state transfer	Others	0.02
All	Sub-total	0.59
Total NSW production	Total	1.4
Overseas imports	Total	0.06
NSW horticulture demand		**1.5**

Source: TPA analysis, Horticulture Innovation Australia 2016

The Riverina, Murray and Sydney Basin in NSW are the key horticultural production regions. Sydney Markets at Flemington, as the central market for NSW, is the predominant destination for the supply of fresh horticultural produce for Sydney and regional NSW, accounting for around 1.3 million tonne of products. The balance of the production goes to processing or exports.

Future demand for horticultural products in NSW is expected to broadly grow in line with the population, at around 1% p.a. per annum. Due to limitations on agricultural land within the Sydney basin, the share of horticultural produce sourced from interstate is likely to increase over time.

Table 34: NSW horticulture demand forecasts, 2016–2056, mtpa

	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
All end user demands	1.5	1.8	2.2	1.0%	49%

Source: TPA analysis, TZP 2016 population forecast

Figure 27 displays the origins-destinations for horticulture commodities supplied fresh to markets. These represent 88% of total fresh market demand.

Figure 27: Key origins- destinations for domestic fresh market horticulture commodities, 2036 forecast

Source: TPA analysis

5.11. Dairy

The term dairy is encompasses products containing or made from milk. NSW is Australia's second largest producer of dairy, with a focus on the production of milk for domestic trade.

Information from the DPI indicates that approximately 70% of milk produced is used for drinking, with the other 30% being used in the manufacture of other dairy products. Production of dairy (drinking milk and other dairy), by NSW region, is listed in Table 35 below.

Table 35: NSW dairy production forecasts by region, 2016–2056, mtpa

NSW region	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Southern	0.2	0.2	0.2	1.1%	57%
Northern	0.1	0.2	0.2	1.1%	56%
Eastern	0.6	0.8	0.9	1.1%	56%
Total NSW	**0.9**	**1.1**	**1.4**	**1.1%**	**56%**

Source: TPA analysis, NSW Department of Primary Industries, Productivity Commission 'Relative Costs of Doing Business in Australia: Dairy Manufacturing

The key end user forecasts for dairy are listed in Table 36 below.

Table 36: NSW dairy demand forecasts, 2016–2056, mtpa

Commodity	End user market demand driver	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Raw Milk	Dairy processors	1.3	1.7	2.1	1.1%	58%
Drinking Milk	Human food consumption	0.9	1.1	1.3	1.1%	56%
Other Dairy (Cheese, Butter and Yoghurt)	Human food consumption	0.1	0.1	0.1	1.3%	70%
Total dairy products*	Human food consumption	0.9	1.2	1.4	1.1%	56%
Total	**All end user demands**	**2.2**	**2.9**	**3.5**	**1.1%**	**57%**

Source: TPA wholesale retail analysis, TPA TZP 2016 forecasts. * The numbers here are slightly different to those in the above table due to rounding differences.

Raw milk

Since total inbound raw milk demand is driven by drinking milk and other dairy production demand (which both grow in line with population growth, excluding exports), raw milk demand is forecast to grow at a rate that is slightly above population growth over the next 15 years (sourced from TZP 2016 data), and at the rate of population growth, thereafter.

Other dairy

Other dairy includes cheese, yoghurt and butter.

Other dairy production is driven by NSW consumption (domestic end users), and exports (overseas end users). Other dairy production that serves NSW consumption is forecast to grow in line with population growth. This reflects historical cheese production data (from Dairy Australia), showing growth rates reflecting population growth.

Other dairy exports

Other dairy exports are forecast to grow at 2% for the next 15 years, before falling to grow at the rate of population growth. According to MariTrade/ABS data, exports were 0.01mt for 2016.

TPA has assumed that Bega, Fonterra and the Murray Goulburn Co-op each export a small percentage of their production through Melbourne Ports and Port Botany (Fonterra exclusively). These volumes are captured in Table 35.

Other dairy imports

NSW consumption of other dairy has been estimated by adding domestic production and imports (overseas production that serves excess demand). Based on import data from ABARES, it has been assumed that 29% of imports of other dairy are destined for NSW.

NSW imports of other dairy are forecast to grow at 3% per annum over the next five years, before falling by 0.2% annually until 2033, where they are expected to grow in line with population growth. National imports have averaged 4% over the last five years, however per capita consumption is not expected to continue to increase in line with this level of growth.

With production forecast to grow in line with population, the net result is consumption growing at a rate that is slightly above population in the short term (due to the higher imports growth rate).

Drinking milk

Dairy Australia data indicates that the total NSW milk production was 0.85 million tonnes for the base year (2016).

For the forecast years, TPA has applied the annual population rate increase from the TZP 2016 forecasts to both drinking milk supply and consumption. Historical consumption data over the last decade averaged 1% annually, indicating that increases have been largely in line with incremental changes in population.

The Australian Dairy Situation and Outlook Report (2017), from Dairy Australia, indicates that growth in production is expected in the coming years as NSW farmers expect to increase their herd sizes and productivity.

5.12. Wine

The wine demand forecasts reported here represent the level of demand from end users, independent of supply side constraints. Possible constraints include the available plantation area, yields and capacity limits at production facilities, export terminals and on the landside freight network.

These wine forecasts cover grapes for production as well as wine that is produced from them.

Production of wine, by NSW region, is listed in Table 37 below.

Table 37: NSW grape production forecast by region, 2016–2056, mtpa

NSW region	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Southern	0.4	0.5	0.6	0.8%	39%
Northern	0.0	0.0	0.0	0.8%	39%
Western	0.0	0.0	0.0	0.8%	39%
NSW	**0.4**	**0.5**	**0.6**	**0.8%**	**39%**

Source: TPA analysis, ABS Catalogue Number 7121.0 Agricultural Commodities NSW (Table 2) various years, Wine Australia 'State of Australian Wine' 2016
*Due to rounding at the one decimal place level, some values appear indeterminate at 0.0. For more specific values, see the underlying commodity forecast spreadsheets, which are listed at the three decimal place level.

A summary of the forecast outputs for grapes and wine production are listed in Table 38.

Table 38: NSW wine demand forecasts, 2016–2056, mtpa

End user market demand driver	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Exports	0.1	0.1	0.1	0.3%	14%
Domestic human consumption	0.2	0.2	0.3	1.1%	56%
All end user demands	**0.3**	**0.4**	**0.4**	**0.8%**	**39%**

Source: TPA analysis, PwC 'Containerised Cargo Demand Assessment Riverina and South West Slopes and Plains' report for TfNSW 2014, The Senate Rural and Regional Affairs and Transport References Committee 'Australian Grape and Wine Industry' 2016

Grapes

- TPA has used grape harvest data from the ABS, to calculate the total supply of grapes in NSW SA3's.
- A grapes-wine conversion factor (sourced from Wine Australia), has then been used to estimate the proportion of these grapes going into various wine producing SA3's.

Wine exports

TPA has forecast that NSW wine exports will fall by 2% until 2026. After 2026, wine exports are anticipated to grow at an average rate of 1% p.a. until 2056.

The rationale for this is as follows:

- The world market for wine is currently oversupplied. Australian (and NSW) wine exports have grown at unsustainably high rates over the last two decades. TPA is forecasting a notable fall in exports in the short term for the industry to become profitable and sustainable; and
- Whilst exports have increased in value in recent years, volumes have begun to decline. This is due to increased export competition from the USA, Europe and South American in Australia's major wine export markets (Japan and the UK).

TPA has not included forecasts for NSW wine imports. MariTrade/ABS data indicates these volumes being very small (less than 50,000 tonnes for 2016).

Wine consumption

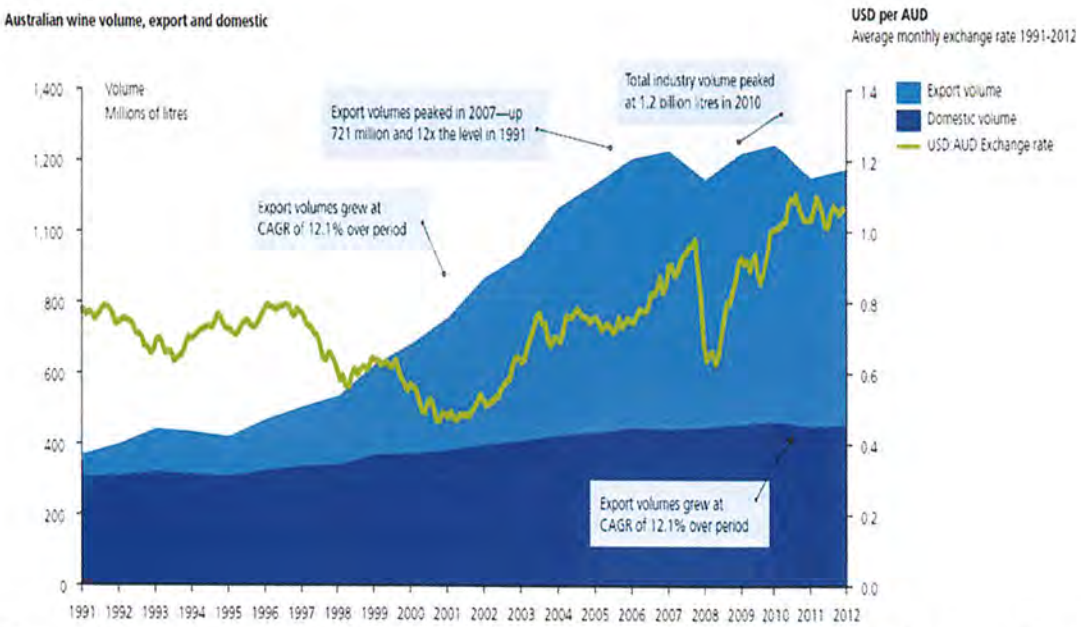
NSW wine consumption is forecast to grow at the rate of NSW population growth.

TPA has based its forecast on national wine consumption data from Centaurus Partners. With the NSW market making up a sizeable percentage of national sales, historical annual growth from 1991-2012 was approximately 0.9% p.a.

Historical national food retail sales averaged 2.7% p.a. growth from 1992-2017, with TPA analysis suggesting that sales are estimated to grow at an average of 2.3% through to 2056. This is significantly more than national wine consumption data, where historical annual growth from 1991-2012 was approximately 0.9%. This is evident in Figure 28 below.

Figure 28: National wine production and consumption

Millions of litres, 1991–2012; USD per AUD



Source: Centaurus Partners 'Wine Industry Report Expert Report on the Profitability and Dynamics of the Wine Australia Wine Industry' report for Winemakers Federation of Australia, 2013

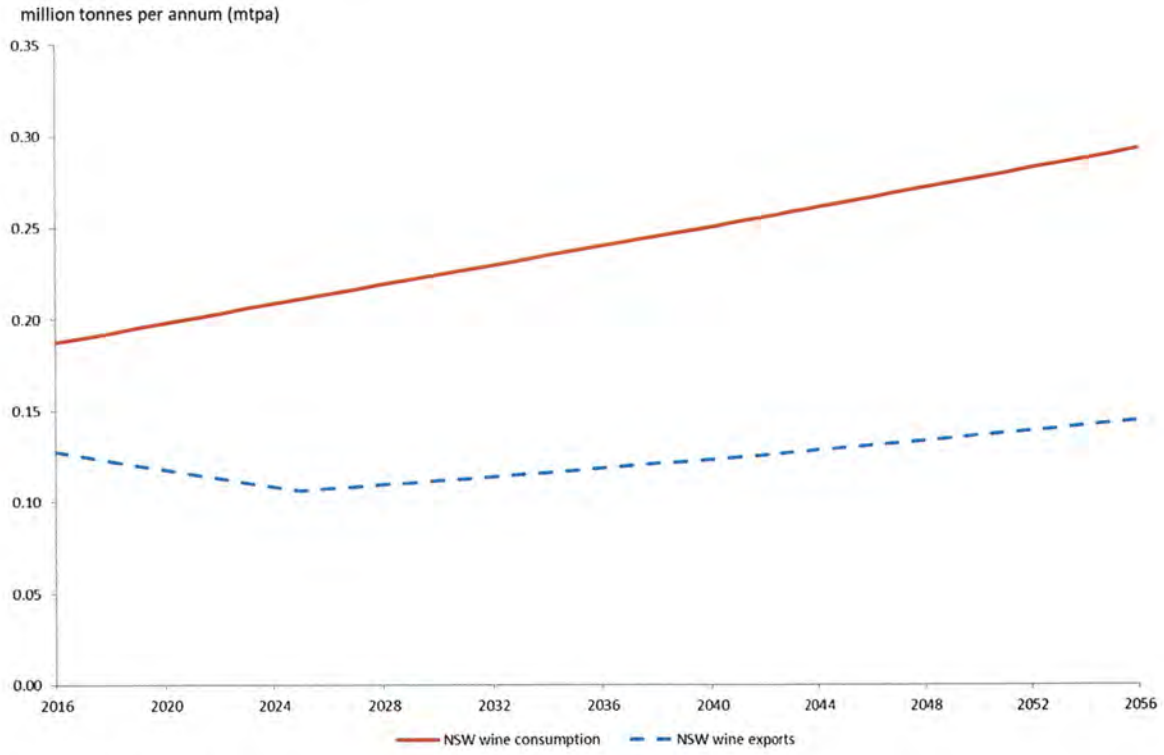
This shows that wine consumption has been stable over time and indicates that wine consumption has largely grown in line with population growth.

NSW wine production has been forecast from levels of production supplied for exports and domestic consumption. This equates to forecast annual growth of 0.8% p.a.

Given that national production volumes have been largely driven by exports, and TPA forecasts that these will fall in the short term. TPA has forecast production to have flat growth

in the short term. The fall in exports will be mostly offset by the modest growth in domestic consumption (in line with population growth). These trends are displayed in Figure 29 below.

Figure 29: NSW wine exports and domestic consumption forecasts



Source: TPA analysis

6 NSW inter-capital

Domestically produced and consumed commodities are transported by road and rail between inter-capital locations.

There are three major commodity categories moving on inter-capital corridors. These are:

- Food and beverages (dry and refrigerated)
- Non-food household consumables (furniture, white goods, computers and clothing)
- Industrial manufactures (chemicals, timber, metals, fertilisers, paints, bricks and tiles).

The distribution of road freight is fairly even across the three commodity categories, while rail is used more for the transport of non-food household consumables and industrial manufactures, as some food is not well suited to rail freight transport.

NSW inter-capital freight includes:

- Freight transported to/from other states moving from/to Sydney
- Freight that travels from / to other States through NSW. This includes mostly commodities that originate in Brisbane and are destined for Melbourne, Adelaide or Perth (and vice-versa).

Forecasts for both sets of OD pair volume demands are shown further below.

6.1. Forecast approach

The inter-capital freight forecasts have been determined as follows:

- TPA estimated base year growth in total NSW demand for the three relevant commodity categories, using DAE base year growth estimates for total NSW consumption demand (which mostly comprises food and beverages and non-food household consumables) and total NSW industrial production (which comprises industrial manufactures).
- The NSW import container growth rate was subtracted from the total NSW market demand growth rate to obtain the domestic production growth rate for the three commodity categories. After adjusting for how much growth in domestic production goes to exports, this leaves a growth rate for domestic production going to domestic consumption. This is the part of the NSW market that can cater for inter-capital demand.
- Using NSW container import and export growth forecasts and DAE's growth forecasts for total NSW consumption demand and industrial production, forecasts were generated for growth in NSW produced commodities consumed by inter-capital customers. These forecast growth rates were applied to the base year inter-capital tonnage data to give forecast inter-capital tonnages out to 2056 for the three commodity categories. These forecast tonnages were assumed to be representative of the Sydney – Melbourne inter-capital freight task. These are shown in Table 39. The rationale is Sydney and Melbourne are large cities with similar growth rates in production and consumption of food and beverages, non-food household consumables and industrial manufactures. Further, NSW and Victoria have fairly similar historical GSP and household income growth rates to each other.

Table 39: Sydney – Melbourne intercapital OD road freight forecasts, 2016-2056, mtpa

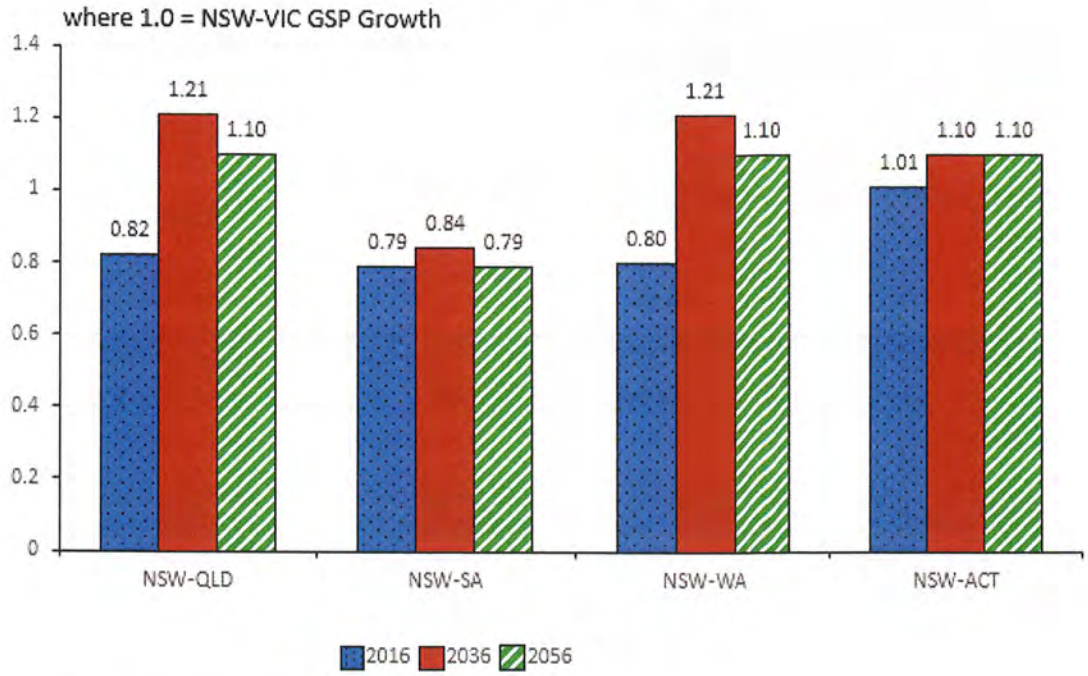
Commodity category	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Food and beverages	5.0	7.2	10.9	2.0%	117%
Non-food household consumables	3.8	4.7	5.6	1.0%	49%
Industrial manufactures	3.8	4.5	5.8	1.1%	54%
Total	**12.6**	**16.4**	**22.4**	**1.4%**	**78%**

Source: TPA analysis

- Growth forecasts for the three commodity categories were not available for the states of Queensland, South Australia, Western Australia and ACT. TPA therefore relied on forecast GSP growth rates for these states as a proxy for forecast growth in the commodity categories. These forecasts are available from DAE.
- TPA estimated a forecast scaling factor where state GSP growth rate pairs were benchmarked to forecast NSW – VIC GSP growth (a simple average of the two states' GSP growth rates). The logic is as follows. If NSW and VIC GSP growth was forecast to be 3% p.a. separately for both states, and QLD GSP growth was forecast to be 3.5% p.a.. Here, NSW – VIC GSP growth would be 3% p.a. (the average of both is 3% p.a.), but NSW – QLD GSP growth would be 3.25% p.a. (the average of 3% and 3.5%). If the scaling factor for NSW – VIC GSP growth is 1, then the scaling factor for NSW – QLD GSP growth would be approximately 1.1 (3.25% divided by 3%). In other words, inter-capital volumes between Sydney and Brisbane are expected to rise by more than inter-capital volumes between Sydney and Melbourne. This is due to stronger expected production and consumption growth in QLD compared to Victoria.

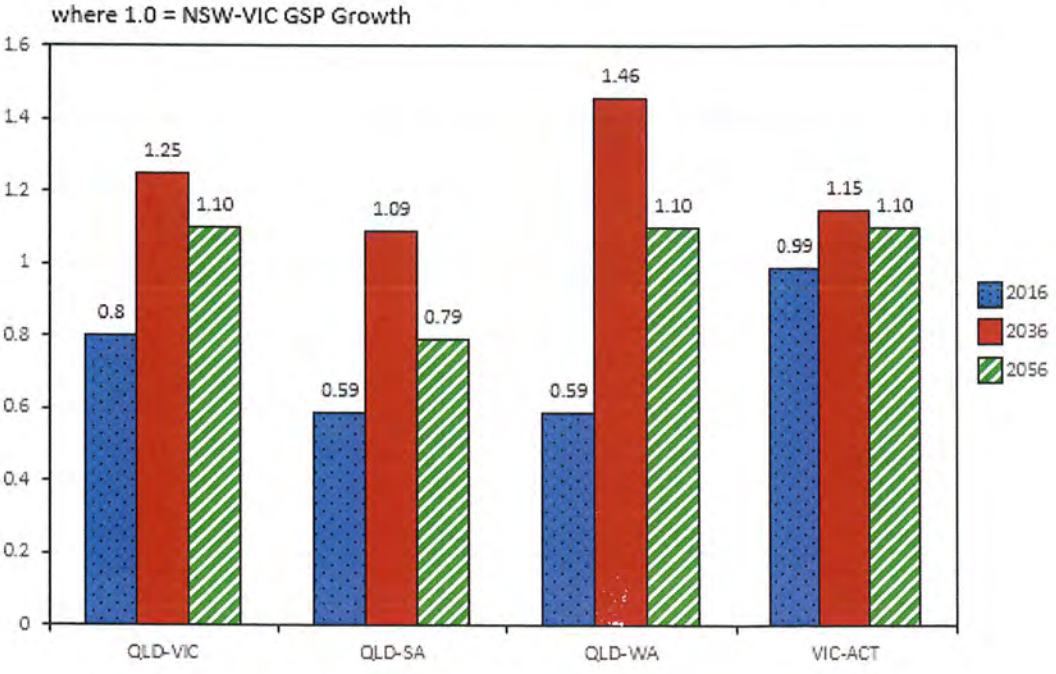
The forecast scaling factors for each state GSP growth rate pair are displayed in Figure 30, which shows the forecast scaling factors for the OD pairs with NSW (and by extension Sydney). Figure 31 outlines the forecast scaling factors for the OD pairs requiring travel through NSW.

Figure 30: Forecast scaling factors for state OD pairs with NSW



Source: TPA analysis, Deloitte Access Economics

Figure 31: Forecast scaling factors for state OD pairs requiring travel through NSW



Source: TPA analysis, Deloitte Access Economics

- The forecast scaling factor for each forecast state GSP growth pair was applied to forecast growth in the volume of the three commodity categories for the Sydney – Melbourne inter-capital market. This gives forecast growth in the volume of the three commodity categories for each inter-capital pair.
- The scaling method allows different production and consumption patterns across states to be captured in the forecasts in a consistent manner.

- TPA assumed no change in mode share between inter-capital road and rail volumes and no material change to road and rail network infrastructure. However, it notes the potential for the future Melbourne – Brisbane Inland Rail line to induce mode switch from road to rail for inter-capital freight with Brisbane origins and destinations.

6.2. Road

Table 40 displays inter-capital road freight demand forecasts for each OD pair with Sydney for the three commodity categories.

- In 2016, there was approximately 25 million tonnes of inter-capital freight moved by road to and from Sydney. Around half of this was Sydney – Melbourne OD freight.
- The road task is projected to increase to 46 million tonnes by 2056. This equates to a forecast CAGR of 1.5% p.a. between 2016 and 2056.

Table 40: Inter-capital road freight forecasts, OD pairs with Sydney, 2016–2056, mtpa

OD pair (both directions)	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Sydney – Melbourne	12.6	16.4	22.4	1.4%	78%
Sydney - Brisbane	8.4	11.5	16.3	1.7%	94%
Sydney – Adelaide	1.9	2.4	3.1	1.2%	60%
Sydney – Perth	0.5	0.6	0.8	1.3%	70%
Sydney – Canberra	1.5	2.1	2.9	1.7%	93%
All	**25.0**	**33.1**	**45.6**	**1.5%**	**83%**

Source: TPA analysis

Table 41 displays inter-capital road freight demand forecasts for each OD pair which requires travel through NSW[4] for the three commodity categories.

- In 2016, there was approximately 5 million tonnes of inter-capital freight moved by road through NSW. Around two thirds of this was Brisbane – Melbourne OD freight.
- The road task is projected to reach to almost 10 million tonnes by 2056. This equates to a forecast CAGR of 1.6% p.a. between 2016 and 2056.

[4] There are no inter-capital road volumes are recorded for the Brisbane-Canberra, Canberra-Adelaide and Canberra-Perth OD markets.

Table 41: Inter-capital road freight forecasts, OD pairs requiring travel through NSW, 2016–2056, mtpa

OD pair (both directions)	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Brisbane – Melbourne	3.2	4.4	6.3	1.7%	99%
Brisbane - Adelaide	1.6	2.1	2.9	1.5%	79%
Brisbane – Perth	0.2	0.3	0.4	1.6%	85%
Melbourne – Canberra	0.2	0.2	0.3	1.7%	98%
All	**5.1**	**7.0**	**9.8**	**1.6%**	**92%**

Source: TPA analysis

6.3. Rail

Table 42 displays inter-capital rail freight demand forecasts for each OD pair with Sydney for the three commodity categories.

- In 2016, there was approximately 2 million tonnes of inter-capital container freight railed to and from Sydney. Around half of this was Sydney – Melbourne OD freight. A notable amount of freight is also railed between Sydney and Perth.
- The rail task is projected to increase to around 3.5 million tonnes by 2056. This equates to a forecast CAGR of 1.2% p.a. between 2016 and 2056.

Table 42: Inter-capital rail freight forecasts, OD pairs with Sydney[5], 2016–2056, mtpa

OD pair (both directions)	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Sydney – Melbourne	1.0	1.3	1.7	1.2%	61%
Sydney - Brisbane	0.3	0.4	0.5	1.4%	73%
Sydney – Adelaide	0.02	0.02	0.03	1.0%	48%
Sydney – Perth	0.7	1.0	1.2	1.3%	65%
All	**2.1**	**2.7**	**3.4**	**1.2%**	**64%**

Source: TPA analysis

Table 43 displays inter-capital rail freight demand forecasts for each OD pair with Sydney for the three commodity categories for each pair.

- The current size of the 'through Sydney' inter-capital rail container task is slightly smaller than the to / from Sydney inter-capital rail container task. Around two thirds of the 'through Sydney' task is Brisbane – Melbourne OD freight.

[5] Note, there are no inter-capital rail volumes consistently moving between Sydney and Canberra.

- The rail task is projected to increase to around 3.0 million tonnes by 2056. This equates to a forecast CAGR of 1.4% p.a. between 2016 and 2056.

Table 43: Inter-capital rail freight forecasts, OD pairs requiring movement through NSW, 2016–2056, mtpa

OD pair (both directions)	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Brisbane – Melbourne	1.1	1.5	2.0	1.4%	77%
Brisbane - Adelaide	0.3	0.3	0.4	1.2%	62%
Brisbane – Perth	0.3	0.4	0.5	1.5%	80%
All	**1.7**	**2.2**	**2.9**	**1.4%**	**75%**

Source: TPA analysis

6.4. Total (road and rail)

Combining all the above forecasts gives a total inter-capital freight demand forecast for NSW. Table 44 shows that approximately 34 million tonnes of inter-capital freight move on the NSW road and rail networks. This is projected to reach 62 million tonnes by 2026. This gives a CAGR of 1.5% p.a. over the 40 year period.

Table 44: Total intercapital commodity demand forecast, 2016–2056, mtpa

OD pair (both directions)	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
All	**33.8**	**44.9**	**61.7**	**1.5%**	**83%**

Source: TPA analysis

7 Summary of forecasts by geographic market

7.1. Sydney GMA

As shown in Table 45 the total Sydney GMA commodity demand is forecast to grow at an average annual rate of 1.7% per annum between 2016 and 2056, reaching around 458 million tonnes by 2056. This is around double the current level of commodity demand.

Table 45: Total Sydney GMA commodity demand forecast, 2016–2056, mtpa

	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Total	**233**	**331**	**458**	**1.7%**	**96%**

Source: TPA analysis

7.2. Regional NSW

Table 46 shows total regional NSW commodity demand is forecast to grow at an average annual rate of 0.6% per annum between 2016 and 2056, reaching 270 million tonnes or a 25% increase from 2015 by 2056. If coal is excluded, average annual growth is forecast to be 1.0% or a 49% increase from 2016 to 2056.

Table 46: Total regional NSW commodity demand forecast, 2016–2056, mtpa

	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Total	**216**	**244**	**270**	**0.6%**	**25%**
Total excluding coal	27	34	40	1.0%	49%

Source: TPA analysis

7.3. NSW inter-capital

Table 47 shows total inter-capital commodity demand is forecast to grow by at an average annual rate of 1.5% per annum between 2016 and 2056, reaching 62 million tonnes or a 83% increase from 2016 by 2056.

Table 47: Total NSW inter capital commodity demand forecast, 2016–2056, mtpa

	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Total	**34**	**45**	**62**	**1.5%**	**83%**

Source: TPA analysis

7.4. Total NSW

Table 48 shows total NSW commodity demand is forecast to grow at an average annual rate of 1.2% per annum between 2016 and 2056, reaching 790 million tonnes or a 64% increase from 2016 by 2056. If coal is excluded, average annual growth is forecast to be 1.6% or a 90% increase from 2016 to 2056.

Table 48: Total NSW commodity demand forecast, 2016–2056, mtpa

	2016	2036 (f)	2056 (f)	CAGR % (2016-2056)	Total increase % (2016-2056)
Total	**483**	**620**	**790**	**1.2%**	**64%**
Total excluding coal	294	410	560	1.6%	90%

Source: TPA analysis